



SATURDAY, MAY 15, 1875.

MASTER MECHANICS' ASSOCIATION.

Report of the Eighth Annual Convention.

The session of the Eighth Annual Convention of the American Railway Master Mechanics' Association opened at the Cooper Institute, New York, on the morning of Tuesday, May 11, Mr. H. M. Britton, the President, in the chair, and J. H. Setchel, Secretary.

At the opening of the session the following members answered to the roll:

Horatio Anderson, Chicago.
J. M. Boon, Pittsburgh, Fort Wayne & Chicago.
H. L. Brown, formerly of Erie Railway.
G. E. Boyden, Boston, Hartford & Erie.
H. J. Brooks, Brooks Locomotive Works.
C. H. Brown, Western Division Delaware, Lackawanna & Western.
N. E. Chapman, Cleveland & Pittsburgh.
S. M. Cummings, Pittsburgh, Fort Wayne & Chicago.
G. A. Coolidge, Fitchburg Railroad.
D. Clark, Lehigh Valley.
George W. Cushing, Chicago.
Robert Curtis, Pittsburgh, Cincinnati & St. Louis.
B. O. Cascadin, Chicago, Rock Island & Pacific.
A. H. De Clercq, International and Great Northern.
J. F. Devine, Wilmington & Weldon.
J. U. Eastman, Nashville & Chattanooga.
Howard Fry, Philadelphia & Erie.
J. H. Flynn, Western & Atlantic.
William Fuller, Atlantic & Great Western.
Charles Graham, Lackawanna & Bloomsburg.
E. Garfield, Hartford, Providence & Fishkill.
Albert Gregg, Worcester & Nashua.
W. E. Granger.
S. J. Hayes, Illinois Central.
C. T. Ham, Buffalo Steam Gauge Company.
W. S. Hudson, Rogers Locomotive Works.
W. B. Healy, Rhode Island Locomotive Works.
S. A. Hodgman, Philadelphia, Wilmington & Baltimore.
J. A. Houghlin, Texas & Pacific.
Joseph Kelly, Providence & Worcester.
Thomas Kerr, Camden & Atlantic.
Sanford Keeler, Flint & Pere Marquette.
B. H. Kidder, Buffalo.
J. N. Lauder, Northern (of New Hampshire).
H. L. Leech, Hinkley Locomotive Works.
Thomas Lingle, Chesapeake & Ohio.
Wm. Lawson, Western Maryland.
W. McAllister, West Jersey.
Charles Metzger, Louisville, Cincinnati & Lexington.
E. Pierce, Pittsburgh, Cincinnati & St. Louis.
S. M. Philbrick, Leavenworth, Lawrence & Galveston.
C. R. Peddle, Vandalia Line.
J. W. Philbrick, Maine Central.
T. B. Purves, Western Division Boston & Albany.
George Richards, Boston & Providence.
W. A. Robinson, Great Western of Canada.
James Sedgely, Lake Shore & Michigan Southern.
W. M. Strong, New York Central & Hudson River.
A. J. Sanborn, Indianapolis & St. Louis.
W. H. Stearns, Connecticut River.
R. C. Stewart.
John Thompson, Eastern Railroad.
J. K. Taylor, Old Colony.
J. Van Vechten, Erie.
W. Woodcock, Central of New Jersey.
J. L. White, Evansville & Crawfordsville.
And the following associates:
M. N. Forney, Railroad Gazette.
Gordon H. Nott, Boston.
Coleman Sellers, Philadelphia.
Jerome Wheelock, Worcester, Mass.
The following master mechanics became members by signing the constitution at the opening of the session:
P. M. Wilder, Erie Railway.
V. Blackburn.
Robert Wallace.
Rufus Hill, Camden & Atlantic.
J. C. Haggert, Dunkirk, Allegheny Valley & Pittsburgh.
M. M. Pendleton, Seaboard & Roanoke.
B. B. Harding, Raleigh & Gaston.
William A. Foster.
L. C. Noble, Houston & Texas Central.
S. E. Brain, New York, New Haven & Hartford.
James Strode, Northern Central.
W. A. Dripps, New York & Oswego Midland.
W. Le Seur.

ADDRESS AND REPORTS.

Below we give the President's address in full and careful summaries of the reports of the Secretary and the Treasurer, and of most of those committee reports which were read during Tuesday's, Wednesday's and Thursday's sessions:

ADDRESS OF THE PRESIDENT.

Mr. H. M. Britton, late Superintendent of the White Water Valley Railroad, who has been President of the Association from its first organization, made the following address:

Gentlemen of the Association:

Let us rejoice in this reunion. Again it is our happiness to re-echo those words of welcome which for eight consecutive years have sprung spontaneously from our hearts and lips. I congratulate you upon this large gathering of our fraternity; I congratulate you on the prosperity, harmony and usefulness of our Association.

Gentlemen, without confining myself to our particular department of railway management, I have taken the liberty in past years, so far as I have been able, to review with you the prominent features in the general condition of the railways throughout the country.

I have not sought to be an alarmist nor a prophet of ill, yet I could not avoid pointing out to you what seemed to me the tendency, from the gross errors and extravagances which have obtained so strong a hold upon our railway economy.

The results which you and I then foresaw have followed, and we are in the midst of a widespread railway bankruptcy.

I am not about to discuss it. This is not an occasion to be given up to painful subjects; but I should fail in my duty, gentlemen, and you will fail in what the railway interests of the country have a right to expect from you, if we do not attempt to show how the equipment of railways can be so reformed as to aid in restoring this great interest to a solvent condition.

Gentlemen, this railway bankruptcy has given rise to various expedients for overcoming it. Among other remedies, "narrow-gauge railways" have been widely recommended, as capable of so much cheaper operation that their adoption would work a cure. I refer to this, not for the purpose of discussing the question of gauge, but to call your attention to the fact that where the narrow gauge has been adopted, the great practical effect has been to materially reduce the weight of rolling stock.

Here, gentlemen, it is well to pause for reflection; here we are touched in our own department of railway economy; here we are affected where we alone are concerned, and where we have the whole responsibility.

If a narrow-gauge railway can be operated at materially less expense than one of the ordinary gauge, chiefly because the rolling stock in use upon it is lighter, or, to speak more correctly, because there is less dead weight hauled upon the narrow gauge in proportion to the paying weight than upon the ordinary gauge, is there not a remedy at once to be applied to reduce the cost of doing business on railways of the ordinary gauge by reducing the weight of the rolling stock?

Gentlemen, during the last twenty years railways of the ordinary gauge have not changed in their superstructure, in their bridges, nor in their iron; but the rolling stock in use upon them has increased in weight from 50 to 100 per cent., and the usual load for a freight car has increased 50 per cent. The same bridge and the same iron, and yet an enormous increase in the weight which is constantly bearing down to crush that iron and those bridges. Gentlemen, can anything be more obvious than that if the proper proportions formerly existed between the superstructure, the iron and the bridges, and the weight of the rolling stock, those proportions are now entirely out of balance?

If a locomotive that weighed 22 tons and a freight car that carried eight tons and a passenger car that weighed 15 tons were suitable to railways of the ordinary gauge 20 years ago, how is it that without changing the roads we are now operating on them locomotives weighing 38 tons, and upward, freight cars loading 12 tons and upward, and passenger cars varying from 20 to 35 tons?

I believe, gentlemen, that these are essentially the facts of the case; I believe they have had a material influence in producing the present railway bankruptcy; and it seems to me that it does not speak well of our influence as master mechanics that we have not been able to do more with railway managers in preventing the use of rolling stock of such enormous weight.

At this meeting and as an association it is our duty to do all in our power to correct this great evil. We must show that a change of gauge is not what is required, but a change in the weight of the rolling stock. The present gauge—the gauge of Stephenson—will answer for all main lines of railway if the dead weight of rolling stock is not so out of proportion to the paying weight as to be a burden upon the commerce of the country, by materially affecting the earnings of the railways.

The reports presented at the last annual convention were well prepared, for which the committees deserve great credit. Each member should render such assistance as he can to the committees, by answering their circulars early, so as to give them ample time to prepare their reports before our annual meetings.

After the reports have been read in open convention, and are ready for discussion, all should take an active part and enter into the discussion, so that we may arrive at important and valuable facts that can be reached in no other way. I trust that no member of this Association will hesitate to give us the benefit of his experience upon any topic that may come before the Convention, for it is only by a free interchange of thoughts and views, openly expressed in a frank and candid discussion, that we can arrive at the object of our Association.

Gentlemen, the question is often asked, why we, as an Association, do not arrive at definite conclusions. This question should be carefully considered. If we meet each year in convention, hear the reports of the committees and fully discuss them, I doubt if there is a necessity of any definite action as a convention. We can each judge from the reports and discussions as to what is the best material, and which the best manner of construction.

At our fifth annual meeting the Committee on Computing Mileage recommended a uniform system of keeping "mileage" and "repair" accounts, which was adopted. It is to be hoped that all who publish their reports will follow their recommendation, so that as we compare reports we can do so understandingly.

Gentlemen, we are under many obligations to the *Railroad Gazette* and other mechanical papers of the country, and to the press generally, for printing our circulars, reports and other matter.

Your Secretary has performed his duties the past year with the same skill and correctness for which he is characteristic. The duties of that office are increasing each year.

The Committee on Assessment should commence their work early in the session, and each member present should settle with the Committee, thereby saving the great trouble of sending through the mail.

Gentlemen, the city of New York is fast becoming the commercial centre of the civilized world. In every age the commercial capital of the world has become the seat of the mechanical arts. There they have found their greatest development and their largest usefulness. The commercial capital of this country, the destined centre of the commerce of the world, in this age makes no exception to that law of all the past. This period far surpasses, in mechanical devices applied to commerce, all that have preceded it. The infancy of the present application of the steam engine to navigation was here. Robert Fulton, after having had his proposals rejected by Napoleon the Great, launched the first steamboat on the Hudson River. From that birth have sprung the wonderful applications of steam to commerce by land and by water, without using and enjoying which, we cannot move to or from New York. New York steamers now vex every ocean and every sea, and New York capital causes a thousand locomotives, traversing the entire continent, to visit every city, eye, and every hamlet from beyond the Lakes to the Gulf, from every portion of the Atlantic shore to the slopes of the Pacific Ocean.

Gentlemen, I thank you for your attention while I have been making these crude remarks; I thank you for the many acts of kindness shown me since the formation of this Association.

I now invite you to enter upon the business of the Convention.

SECRETARY'S REPORT.

Mr. J. H. Setchel, the Secretary, reports a statement of the condition of finances, membership, etc.

Since his last year's report, six members have resigned, and 37 new ones have joined the Association, 30 having joined at the last convention and seven since. The names of 16 members, now two years in arrears for dues, will be dropped hereafter. Excluding these, there are now 222 members, and 12 associates.

Fifteen hundred copies of the Seventh Annual Report, which contained 327 pages, were printed. Of these, 975 were sent to members, 150 to other master mechanics, and 15 to others who applied for them. An expense of \$121 was incurred for postage on reports, circulars, etc. The Secretary has still on hand 644 of the First and Second Annual Reports (printed together), 151 of the Third, 54 of the Fourth, 287 of the Fifth, 109 of the Sixth, and 273 of the Seventh.

The Secretary suggests that members who can receive express packages free have the next report sent them by express, as the postage has been doubled by the recent act of Congress.

TREASURER'S REPORT.

The report of S. J. Hayes, Treasurer, shows a balance on hand at the beginning of the year amounting to \$298, and an income of \$2,094, a total on the debit side of \$2,396. Out of this was paid \$500 to the Secretary, \$258 for reporting proceedings, \$1,490 to Willatch, Baldwin & Co., for printing, and \$125 for other expenses, leaving a balance of \$23 on hand. There was a

balance of \$313 due the printers, and \$660 due the Association from its members.

REPORT ON THE BEST MATERIAL, CONSTRUCTION AND OPERATION OF BOILERS.

This Committee, consisting of James M. Boon, Pittsburgh, Fort Wayne & Chicago; J. A. Jackman, Chicago & Alton, and G. W. Cushing, late Toledo, Wabash & Western, report that they have data from about 200 boilers with outside sheets and waist of steel; from one of iron with steel throat sheets, and of 200 with outside shell wholly of iron. In all cases a favorable report is made of the steel boilers, though in some cases the objection is made that the excess of cost of steel over good iron is greater than the advantages obtained by its use. The Committee has reports from both steel and iron fire-boxes, but none from parties using copper for that purpose. With wood-burning engines the steel fire-boxes are giving general satisfaction. With engines burning bituminous coal there are many complaints of cracks in the side sheets after a service of from six months to two or three years. These cracks generally start a short distance above the grate and are sometimes straight, between the stay-bolts, sometimes zigzag, running from stay-bolt to stay-bolt, and have taken place at different times, sometimes when the boiler was being filled with cold water, at others when the boiler had been standing for some time with the same water after coming off a run. A report has been received from a steel fire-box with iron crown sheet, and of iron fire-boxes with copper side sheets, both doing well. With iron fire-boxes complaint is made of cracking and also of blistering, the latter being caused by imperfect welding of the iron, and taking place with any fuel, more rapidly, perhaps, with coal than wood. No reports have been received from engines burning anthracite coal.

From the information received and their own experience the Committee believe that good homogeneous steel that will not harden is the best material for boilers and fire-boxes. While it costs about 20 per cent. more, weight for weight, than iron in outside shells, this is off-set by the use of thinner sheets. For a 48-inch boiler 5-16 inch steel can be used instead of 3/4 inch iron, the usual thickness, making the cost of material about the same with the advantage of a lighter boiler. There has not been sufficient experience with steel to judge of its durability, but it is believed it will stand corrosion better than iron. A steel boiler recently examined after three years' service showed no signs of corrosion.

With wood-burning fire-boxes steel is giving the best results, as it will not blister and lighter sheets can be used. The best quality of iron that will not blister will last from eight to twelve years with wood. With bituminous coal copper fire-boxes are objectionable, as the plates wear away to a dangerous thinness from the mechanical abrasion of the fine coal and cinders, and this wear can only be detected by drilling holes, as the plates wear between the stay-bolts, but are forced into line by the pressure and present an even surface to the eye. The average life of a copper fire-box is from three to five years; some have given way in eight months, and others are recorded as lasting eight years. The objections to iron fire-boxes are the difficulty of getting iron that will not blister, and its tendency to burn out and become brittle.

With steel the main objection urged is its cracking. The advantages are the greater durability and the use of thinner sheets, presenting less obstacle to the transmission of heat. The committee have records of 41 steel fire-boxes among the first in use: the average duration of the three highest was 9 1/2 years; the three lowest 4 1/2 years; and the whole 41, 6 1/2 years. They have also examined fire-boxes in use 4 years and 1 month, and now in perfectly good order, without a patch. They have also a record of 80 steel fire-boxes, the oldest in use 8 years. In this number six sheets have cracked from various causes.

The committee believe the greatest trouble with steel is that the metal as manufactured is not uniform. Manufacturers of steel should take this matter in hand, and also consider the fact that it is probable, in the opinion of the committee, that some chemical action, as yet imperfectly understood, takes place between the gases of combustion and the steel plates of the fire-box.

Iron tubes are used almost exclusively in coal-burning engines; where the water is bad they have to be taken out in from 8 to 30 months. The action of the coal is to wear off the beading and start them to leaking.

In construction there has been nothing new during the year, but few engines having been built. The general practice is to use 3/4 inch iron or steel for outside sheets, 5-16 inch iron or steel for fire-boxes, and from 3/4 to 1/2 inch for tube sheets. Water spaces around fire-box from 2 1/2 to 3 1/2 inches inside, and from 2 1/2 to 4 inches in front. At straight seams 11-16 inch rivets are used, spaced 1 1/2 inches between centres. Longitudinal seams double riveted, centres of the two lines of rivets 1 1/2 inches apart, centre to centre of rivets on same line, 2 1/2 inches. Stay-bolts 3/4 inch diameters, 4 inches center to center. The committee believe that thin plates give the best result in fire-boxes, sides and back of 3/4 inch steel, crown sheet 5-16 inch steel, and tube-sheet 1/2 inch. Tube sheets of 7-16 inch iron, the other plates being steel, have also given good results. It is believed that 3/4-inch steel plates are strong enough for side sheets and less liable to crack than thicker plates. They are also more easily straightened when sagged down from mud collecting on it, and will not crack so quickly from over-heated crown-bar bolts. The committee also believe that on coal burners the water spaces around fire-box should never be less than 8 inches, and 3 1/2 is better. In old engines changed from wood to coal-burners with 2 1/2 and 2 3/4 inch water spaces, many fire-boxes are destroyed by burning of the sheets, owing to the water being driven out of the narrow spaces by intense heat. Many good results have been obtained by narrowing the fire-box from bottom to top, giving increased water-space.

Larger sheets are being generally used, giving good satisfaction. It is a general opinion that no advantage has been gained by using large smoke-boxes. In this the committee concur, as they have found that with a large smoke-box the nozzles have to be contracted to an injurious extent to procure the necessary draft.

The Committee have no report of any new boiler attachments. Water gauges are coming into more general use. Injectors, after being discarded for a time, are again used; with coal-burners a common practice is to use one injector and one pump.

With a good boiler 120 pounds is considered a safe working pressure; on some roads 130 pounds is the maximum allowed. With regard to braces from frame to boiler it is a very common practice to rivet angle iron to the bottom of the boiler and connect it by a 1/2-inch iron plate to the guide-yoke (or a plain iron brace) carried across from frame to frame. It is also common to rivet braces to the boiler, the heel under the waist. The Committee condemn both these plans, as corrosion is sure to take place about the rivet heads and the expansion and contraction will break the sheet. All braces from frame to boiler should be fastened to the boiler at the center line and the brace made light, so that the expansion will spring it and not affect the sheets. The Committee believe that in most engines one brace a side is ample.

The life of a boiler depends upon quality of material, purity of water used, design of boiler, pressure carried and care taken of it while in service. Deterioration begins as soon as a boiler goes into service and continues with more or less rapidity. One of the committee has in less than seven years broken up 54 boilers, all of iron, some of them of the very best Pennsylvania charcoal iron, yet after 20 years' service this would break like poor cast iron, showing a fine white grain. The first defects to

show are generally at bottom of waist; at seam of front tube sheet the iron will be corroded; where a brace is riveted to bottom of boiler defects will show around rivet heads. Sometimes the sheets are pitted or corroded in spots from $\frac{1}{4}$ to 3 inches diameter. These defects show in from three to five years and increase with age. Boilers have been condemned for corroding in seven years. The committee believe that 12 years is as long as is profitable to use a boiler, and, where bad water is used, 10 years is enough. It may be claimed that boilers will run 20 years and over, but the fact that they have done so does not prove them to be safe.

Tubes should be removed for examining the boiler at least once in three years, with bad water more frequently, sometimes every year. The only sure way to know the condition of a boiler is to take out the tubes, remove all scale and inspect carefully. There is no safety in testing with pressure, as a boiler may stand the test and yet be defective. An instance is known to the committee where a boiler stood a hydraulic test of 150 pounds to the square inch, and yet exploded three months afterwards with 110 pounds pressure.

COMMITTEE ON THE PURIFICATION OF FEED WATER.

This committee, which consists of Mr. H. A. Towne, Northern Pacific; Coleman Sellers, Philadelphia; H. Elliott, Ohio & Mississippi; W. Wilson, Chicago, Burlington & Quincy; and H. V. Faries, Atchison, Topeka & Santa Fe, reports that while the members of the committee are familiar with experiments that have been going on for the last two or three years in the way of gathering and storing rain and surface water, no direct information has reached them concerning the results. Mr. Reuben Wells, of the Jeffersonville, Madison & Indianapolis, reports that on his road the water stations were changed last winter so as to draw from creeks and surface water instead of the wells formerly used, the water of which carried much lime. The results have already been seen in a marked difference in the performance of engines and a decrease of trouble from leaky flues and joints. Mr. Peddle, of the Terre Haute & Indianapolis, reports that on the Eastern Division, where the water used is mainly from wells and springs and the Wabash and White rivers, both fed by springs, there is much trouble from incrustation, the principal ingredients of which are shown by analysis to be lime and magnesia. On the Western Division, where the water is mostly obtained from ponds and reservoirs supplied by surface drainage, there is very little incrustation, but the water holds much clay in solution, requiring a frequent washing out of the boiler. If this is done and the leg of the fire-box and bottom of the barrel are kept free from mud, there is a marked advantage in durability of fire-box and tubes over the other division.

The committee urge the difficulty of furnishing reliable statistics on this subject without the co-operation of members of the Association. No new arguments are needed to enforce the great importance of the subject, or the fact that purification of the feed-water before its introduction into the boiler is the true remedy for the manifold evils arising from incrustation.

Though excellent results may be had by collecting surface water in ponds or reservoirs, means should be provided for settling or filtering the mud in such water. Prof. J. N. Sewall, of the Illinois Normal University at Bloomington, having, at the instigation of the chairman of the committee, devoted much time to experiments with hard water, has decided that the most effective substance for treating such water is ammoniated phosphate of soda, which will precipitate all the salts of lime, magnesia, iron and alumina, at an expense estimated at one cent per hundred gallons, or half a cent per mile run, while the addition to the cost caused by incrustation is estimated at 2½ cents per mile. The only addition to apparatus needed in using this is an extra tub for every tank, so that water may be drawn from one while being treated in the other. The water would need to be first analyzed, and the precipitating substance then composed to suit its peculiar qualities. It can be applied by ordinary workmen without failure. On the Northern Pacific Railroad, under the direction of the chairman of the committee, 60,000 gallons were treated by this process with quite satisfactory results. None of the chemicals offered in the market for preventing or removing scale are recommended by any members of the Association in their answers to the Committee's circulars. The Committee describe the method of using carbonate of soda for removing scale; they have received flattering accounts of the efficiency of stearic acid, and they purpose to make further trial of it. The condensing apparatus mentioned in last year's report is still used successfully on the Hannibal & St. Joseph road. The more general use of the mud drum is recommended; the mud valve should be blown off several times a day. But the chief dependence for locomotive boilers must be the securing of soft water from the natural surface or the purification of the hard water, if it must be used, before it enters the boiler.

The Committee submit as an appendix to their report a paper by Prof. J. N. Sewall, in which he says that incrustation for the most part consists of salts of lime and of magnesia, those of lime in most cases forming 95 per cent. of the whole. What is needed to purify the water cheaply is a reagent that will remove the alkaline earths completely from cold water without injuring the iron. Some such reagents are enumerated and the difficulties in using them described. After many experiments, he feels prepared to recommend the ammoniated phosphate of soda as best suited for the purpose. It precipitates all the salts usually found from cold water and does not injure iron, but prevents oxidation. The action of this reagent on each of the salts is described.

With this report was submitted a letter to the Committee by Mr. J. H. Setchel, Master Mechanic of the Little Miami Railroad, which says that on that road within four years past very great advantages have been attained by simply changing water stations from places where the supply was from springs of hard water to other places where the supply was from streams and collections of surface water. Changes have been made of six stations, and where an attempt to burn coal had to be abandoned before there is now no trouble and flues last two or three years, one set having been recently removed after 42 months' service and an average run of 114 miles a day in that time, with less scale adhering than was gathered in a year with the old water. Of mechanical and other contrivances for preventing scale when hard water is used, the most effectual tried by Mr. Setchel is a good surface blower.

A thorough trial was made on three of his engines of "Hay's Galvanic Battery," but the scale was fully as heavy on the flues of these engines as on those without the battery.

A long and very interesting letter from Mr. H. V. Faries, Master Mechanic of the Atchison, Topeka & Santa Fe Railroad, was also submitted with the report.

LOCOMOTIVE TESTS.

This Committee, consisting of M. N. Forney, Prof. R. H. Thurston and W. Woodcock, which was appointed to request members to make tests of locomotives to show their performance under various conditions, and to report the results, reported verbally that no such tests had been made, and that therefore there were no results to be reported; and they asked to be continued for another year.

REPORT ON LOCOMOTIVE CONSTRUCTION.

This Committee, consisting of Messrs. J. Sedgley, Lake Shore & Michigan Southern; L. S. Young, Cleveland, Columbus, Cincinnati & Indianapolis; and Howard Fry, Philadelphia & Erie, report that in answer to circulars no replies have been received which point to any improvements in the construction of boiler tending to increased economy in fuel. One of the Committee has tested a device for increasing heating surface by inserting

a number of cast-iron hollow globes secured by a neck into the crown-sheet. While no accurate experiments have been made, it is evident that some saving has been effected, and there has been no trouble from leaky joints or mud settling in the globes. A similar device is in use on marine boilers. No replies have been received concerning the Weston boiler; and while some tests have been in progress, no details have been received. Replies received from members using the Jauriet fire-box do not enable the Committee to draw any accurate comparison between it and the ordinary fire-box with brick arch.

The use of balanced valves appears to be extending, but no definite advance is reported. The Committee believe that cheapness of construction may be promoted without incurring risk of breakage and with good results as to wear by using cast iron for links.

The Committee have received no information leading them to believe that any satisfactory improvement has been made in spark-arresters. One of the members, on a recent visit to England, was forcibly impressed with the fact that no trouble is there found from the throwing of fire, and was led to believe that it is worth a careful experiment to decide whether the arrangement of nozzle and stack there used would give good results in this country.

The Committee visited one road where a Fairlie double-track engine, as modified by Wm. Mason, has been in use 12 months with excellent results. It is believed to be too soon, however, to pronounce any opinion on this pattern of engine, especially in view of the heavy strains thrown upon the boiler. If a powerful engine is needed, those of the consolidation pattern are believed to answer every purpose.

Appended are letters from Mr. H. G. Brooks, of the Brooks Locomotive Works, on the Robert central exhaust engine, and from Mr. R. Hill, of the Camden & Atlantic, on Hill's spark-arrester, the latter being accompanied by detailed drawings.

REPORT ON THE BEST SYSTEM OF SIGNALS.

This Committee, consisting of Messrs. John Thompson, Eastern Railroad; A. B. Underhill, Boston & Albany; and J. Orton, Great Western, report that for the best system of signals for operating trains many roads continue to use the usual appliances, the bell-cord, flags of various colors by day and lanterns by night. On the Eastern Railroad, Hall's automatic electric signals are in use on 16 miles of double track and have been in use since 1873, with some intervals. For nine months past all trains between Boston and Salem have been run by them, with entire success. A complete description of this system is to be found in the *Railroad Gazette* for August 29, 1874. While on most roads the ordinary methods are sufficient, something of this kind is needed on those of the heaviest traffic, especially those doing a large suburban business, where frequent and quick-moving trains are required.

In train head signals the only new thing reported is a system introduced by Mr. Robinson, on the Great Western, of indicating the number of each train by changeable metallic figures placed in front of the head-light. At night red and green oil-silk screens, placed inside of the head-light and in front of the reflectors and fixed on rollers, so as to be worked instantaneously from the cab, are used, and have been found of great service.

In train tail and side signals and switch signals, nothing new is reported.

As to appliances for indicating the speed of trains, several roads report that they have used the train indicator invented by Mr. Wyeth, and described in the *Railroad Gazette* of November 29, 1874, which is regarded as giving valuable results and enabling information to be collected which is of very great service in making up time schedules. The Committee believe that this instrument deserves further attention.

COMMITTEE ON LOCOMOTIVE AND TENDER WHEELS.

This Committee, which consists of Messrs. J. N. Lander, G. W. Stratton and S. A. Hodgman, report that in answer to the circulars sent out replies have been received from 15 different roads. There were reported 57 broken tires on different roads. One instance is reported where a steel tire of good thickness was seen to break from a direct blow, the engineer having slackened speed on account of a very bad joint he had observed in the track, he at the same time watching the wheel closely.

From information and experience the committee believe that at the South steel tires of good quality can be run until they are worn down to 11-16 inches in thickness. Where intensely cold weather is experienced, 1½ inches is a better limit of safety.

Replies to circulars are almost unanimously in favor of shrinkage alone as a method of securing the tire to the wheel center, allowing 1-100 of an inch to each foot of diameter.

In regard to truck and tender wheels the data obtained are very meagre and unsatisfactory. Mr. Sedgley of the Lake Shore & Michigan Southern submits a very complete statement of the performance of engine truck, tender and passenger car wheels on that road, which is appended to the report.

From the Terre Haute & Indianapolis road reports are given of 94 pairs of 30 inch tender wheels with an average mileage of 32,435 miles, and 31 pairs of engine truck wheels with an average life of 46,176 miles. The mileage varied from 60,475 to 13,101 miles.

Mr. Weaver of the Eastern Kentucky has been experimenting with a mixture of hot-blast charcoal iron and steel. They are reported as chilling deeper than the ordinary wheel and have thus far given good results as compared with the ordinary wheel, but have not been in use long enough for a full trial.

On the Boston & Providence road, Mr. Richards reports two pairs of solid Bochum cast steel truck wheels in use two years with scarcely any perceptible wear. The Washburn steel-tired wheels are also reported as giving good results. On the Toledo, Wabash & Western, Mr. Johann reports about 1,000 engine truck and tender wheels, giving an average mileage of about 40,000 miles. Mr. Finlay, of the Cairo & Fulton, reports that 200 wheels from a well-known foundry gave an average run of 40,000 miles, while 168 from another maker averaged 12,000 miles only. Mr. Lander of the Northern (N. H.) Railroad reports that of 68 steel-tired engine truck wheels (26 and 28 inches diameter) eight have failed after running 30,000 to 40,000 miles, while others are in good condition after 2½ years' service. A table giving mileage of these wheels is appended to the report. These wheels are made by heating the tire to a bright red, putting it in the mould and then running molten cast iron through until the tire is brought to a welding heat. The flow of iron is then stopped and the mould allowed to fill.

REPORT ON CONSTRUCTION AND IMPROVEMENTS OF CONTINUOUS TRAIN BRAKES.

This Committee, which consists of Messrs. Charles R. Peddle, Terre Haute & Indianapolis; George Richards, Boston & Providence, and F. Gould, late of Missouri, Kansas & Texas, reports that only nine replies, nearly all brief, were received to the circulars. On all the roads reporting the Westinghouse air brake was in use. The cost of repairs per engine per year is reported by five roads and varied from \$17.40 to \$37. Only two roads report the cost per car per year, the amounts being \$4.35 and \$4.65 respectively.

One accident is reported resulting from the breaking of a hose and the consequent failure of the brakes to work. A number of instances are recorded where serious accidents were prevented by the use of the brake.

With regard to the automatic improvement of the Westinghouse brake, the replies indicate a difference of opinion, some master mechanics considering its use essential, while others believe that the advantages gained are not sufficient to counter-

balance the increased complexity, and therefore prefer the original and simpler form of the brake.

It is generally considered that where the air cylinders are regularly cleaned and lubricated and the brake properly handled, there is no trouble in starting up a train after using it. Crude petroleum is recommended as a lubricant for the piston leathers. One member of the Committee experimented with a release valve attached to the car cylinders, which permitted a sudden exhaust of the air from them, but the results were not satisfactory, there being a disagreeable concussion of the cars and too great loss of air, where the brake was used often.

As to durability of car wheels, the Committee do not believe that it is any greater with power than with hand-brakes, but this is a difficult question to decide. Two roads reported the application of air-brakes to the driving-wheels of engines, but no special experiments have been made as to their efficiency.

The Committee, while admitting the advantages of the Westinghouse brake, believe that the air brake of the future must combine those advantages with a simpler and cheaper compressing apparatus, but in what way that can be attained is a problem yet to be solved.

Reference is made to the Henderson hydraulic brake, recently tested on the Westchester & Philadelphia road, and to the McBride hydraulic brake, which is similar in principle to Henderson's, but differing in details, McBride having adopted the Westinghouse car fixtures complete. The Committee is of opinion that a fluid like water, having less elasticity than air and a slower movement, cannot be so desirable as a means of transmitting power to a brake. Much stress is laid by inventors of brakes on their ability to make short stops, but these are too frequently accompanied with that sudden and disagreeable concussion which the air brake avoids.

The report contains a careful calculation of the retarding power exerted by a good continuous brake in stopping a train, say of engine and six cars, weighing 170 tons in all, at a speed of 40 miles per hour on a straight track, and suggests the comparison of the theoretical results with those ascertained by actual experiment.

The Committee regret that no reports were received from roads using the Smith vacuum brake, as a comparison of results with the air brake would have been instructive. The Westinghouse air brake is now in use on over 100 roads, the Smith vacuum brake on 13, and the Loughbridge air brake on two.

REPORT OF COMMITTEE ON STANDARD AXLES.

To the American Railway Master Mechanics' Association:

GENTLEMEN: The committee to whom this subject was referred back at your last annual convention for further consideration, in order to comply with the request then made, that the reasons which induced them to make the recommendation contained in their report should be given more fully, issued the following circular of inquiry:

"At the last meeting of the American Railway Master Mechanics' Association, the subject of a standard for car and tender axles was referred back to the Committee to whom it had been submitted, with a request that the reasons should be given for the adoption of the standard form and proportions which were recommended. As a large number of axles of that kind have been put into use since then, the Committee have delayed issuing their circular to this late date, in order to get the fullest reports possible of the experience in the use of that kind of axles. They therefore present the following inquiries, which it is to be hoped will be answered immediately, so that the Committee may be able to present the latest accessible information relating to the important subject submitted to their consideration:

"1. What are the sizes of journals used under locomotive tenders and cars on your road?"

"2. Which sizes give the least trouble from heating?"

"3. If possible, report the number of axles broken during the past year on your road and the sizes of each. If it is not possible to give the actual number of each kind broken, give your opinion formed from observation of the relative proportion of breakages of each kind.

"4. Have you observed any difference in the relative amount of power required to draw cars with axles having large as compared with those having small sized journals; if so, how did the amount of power required for the one size compare with that for the other?"

"5. Have you noticed any difference in the wear of brasses and the consumption of oil on different sized journals; if so, give the Committee any data you may have or the results of your observation?"

To this circular the committee received 26 answers. The replies to the first inquiry, "What are the sizes of journals used under locomotive tenders and cars on your road?" it is not thought necessary to report. To the second, "Which size gives the least trouble from heating?" 15 of those who answered the circular do not report any difference; nine say that the largest journals they use give the least trouble, one is in doubt and one says that, owing to the construction of the boxes with the small journal, they give less trouble than the larger ones. In reply to this inquiry, Mr. Wells, of the Jeffersonville, Madison & Indianapolis Railroad, says: "The standard size of car-axles adopted by this company in 1852 had 3½ × 5½ in. journals, and at present about 30 per cent. of the cars have under them journals of that size. The balance have the standard size, 3½ × 7 in. adopted in 1865. The latter gives much less trouble from heating than the old and smaller size of journal. This was demonstrated in the case of two large baggage, mail and express cars on this road having six-wheeled trucks under them, with 3½ × 5½ in. journals. The cars when empty weighed 45,800 lbs. When they were heavily loaded and on fast trains more or less trouble was experienced with hot boxes. After several years' use the trucks were rebuilt, and axles with 3½ × 7 in. journals put under them. Since that time (three years ago), such a thing as a hot box under them has scarcely been known. The same can be said also of freight cars hauling heavy loads, and the difference in this particular in our experience has been quite marked."

To the third inquiry, about the number and proportion of broken axles, the replies are, most of them, so indefinite that it has been impossible for the committee to gain the information which they hoped to elicit by this question. Five of the circulars received contain no reply to this inquiry; five report that they have had no broken axles during the past year, and the balance report 63 broken axles during the year.

To the fourth inquiry, "Have you observed any difference in the relative amount of power required to draw cars with axles having large as compared with those having small-sized journals?" 12 of the circulars contain no answer, 12 have noticed no difference and two report that cars with large journals require more power to draw them. One of the latter is of opinion, however, that it may, perhaps, be attributed to other causes and not to the size of the journal. Mr. Charles R. Peddle says he has not observed any difference, "but from some experiments made to test the relative friction of different sized journals, in a machine improvised for the purpose, I am convinced that the usually received opinions in regard to axle friction cannot be correct. I apprehend that in starting from a state of rest and at very slow speed, say one to ten revolutions per minute, that the resistance of journals is in proportion to diameter, but that at higher speeds and with ample lubrication there is no appreciable difference, and also that the friction of journals, within the range of dimensions used for car axles and under the ordinary loads, diminishes to a very small amount at high speed; and that the increased leverage of resistance of large journals is compensated by the diminished friction

consequent upon the increased velocity of the surface. I doubt if this will hold true of badly lubricated surfaces, and I also think that more frequent lubrication may be necessary with larger journals, but am not certain about that. The subject is one concerning which some careful experiments are needed, as we are, I think, all afloat as to the proper understanding of the laws of friction as applied to axles."

Mr. Geo. Richards, of the Boston & Providence Railroad, says: "Have noticed no difference; if any it is in favor of the Master Car-Builders' standard axle."

Mr. Jacob Johann, of the Toledo, Wabash & Western Railroad, says:

"Am not prepared to say, not having made any experiments. I am of the opinion that within a limit of journal size, the load and other circumstances being equal, the large journals will 'draw' as freely and require no more power than the small ones, and they wear decidedly better and longer."

Mr. J. W. Philbrick, of the Maine Central Railroad, says: "We draw freight cars having large journals, of other roads, over our road. These are the cars that give us the most trouble on account of drawing hard and hot boxes. We think we can draw one-fourth more Maine Central cars than of those referred to. We say the reason is because of want of oiling on the part of the company that sends such cars, and because of the bad quality of the brasses used, and not on account of the size of the journals. Possibly smaller journals would not serve as well as the large ones under like treatment."

Mr. Wm. H. Ellis, of the Catwissa & Williamsport Branch of the Philadelphia & Reading Railroad, says: "The cars with axles having $3\frac{1}{2} \times 8$ in. journals require more power to move them than the smaller sizes. We have a grade 35 miles long, of 36 feet to the mile, and we find that it requires as much power to move 16 loaded freight cars with $3\frac{1}{2} \times 8$ in. journals as it does to move 18 similar cars with $3\frac{1}{2} \times 5\frac{1}{2}$ in. journals."

To the fifth inquiry, "Have you noticed any difference in the wear of brasses and the consumption of oil in different sized journals?" 11 of the circulars named contain no answer, five say, have no information. The remaining replies to this inquiry are as follows: Mr. J. M. Boon, of the Pittsburgh, Fort Wayne & Chicago Railway, says: "Last year, I was inclined to favor a short journal ($5\frac{1}{2}$ in. long). Am now satisfied I was wrong, and am in favor of a journal of 7 in. for all kinds of rolling stock, believing that better results can be obtained. I do not think there would be any saving in oil or any more used than in a $5\frac{1}{2}$ journal, but believe a 7 in. journal will give better results in the wear of brass bearings than the short one with the same amount of oil."

Mr. Johann says: "From observations in the running of large journals, I notice that the large brasses endure more wear and consume less oil than the small ones." Mr. Ellis: "The wear of brasses is about 6 per cent. in favor of the $3\frac{1}{2} \times 8$ in. journals." Mr. Wm. F. Turrell, of the Cleveland, Tuscarawas Valley & Wheeling Railway, says: "The wearing of brasses and the saving of oil is very largely in favor of the large journals." Mr. W. A. Robinson, of the Great Western of Canada, says: "Our observations tend to show that the large $6 \times 3\frac{1}{2}$ in. journals require less oil and give better results than those of $5\frac{1}{2} \times 3\frac{1}{2}$ in." Mr. John Hewitt, of the Atlantic & Pacific, says: "From general observation am satisfied that large journals give better results in use of oil and wear of brasses than small ones."

The committee have endeavored to give as fully and as accurately as the space and time at their disposal would permit the substance of the replies which they have received to their inquiries. These have confirmed your committee in the views which they held last year, and which were embodied in the recommendation made in their report at that time. They believe that in the consideration of this subject it is unnecessary to dwell on the importance of having some common standard for car and locomotive tender axles. The experience of every member, it is thought, has long since taught him the importance and value of uniformity in rolling stock, especially of those parts which most frequently require renewal. Before such a system of uniformity can be adopted for all the parts of car and tender trucks, a standard for the form and dimensions of axles must be established. After this is done it will be comparatively easy to adopt a standard for bearings, oil-boxes, pedestals, etc. The question which presents itself for your consideration is, therefore, simply that of the dimensions which shall be adopted for such a standard axle; and as nearly all the other proportions are dependent upon the size of the journal, the question is narrowed down to that of the length and diameter of the journal. As a kindred Association has already recommended a standard for the form and dimensions of axles, the question for your consideration as indicated by the current discussion of the subject is really, whether the dimensions $3\frac{1}{2} \times 7$ in. of the standard axle journal which has been recommended is too large or not.

That friction, within very wide limits, is independent of the area of the surfaces in contact is such a well-established principle that your Committee do not think it necessary to give it any further consideration here. It is also very well known that with excessive pressures per square inch of area lubricants are pressed out from between the surfaces of a journal and its bearing, and then instead of being entirely separated by a filament of oil, as they should be when perfectly lubricated, they come in contact with each other, and instead of floating as it were on the lubricant, as they should if perfectly lubricated, the metal of the bearing comes in contact with that of the journal, and lubrication is then either very imperfect or may be entirely destroyed and abrasion of the surfaces occurs. It has been found by experiment that the coefficient of friction with perfectly oiled journals is only about one-sixth that of journals very imperfectly lubricated. Of course, between perfect lubrication and that which is very imperfect there is every degree of frictional resistance. The amount of pressure per square inch of area of journal-bearing which will admit of perfect lubrication varies of course with the attending circumstances. Thus a journal running at high speeds is more difficult to keep well lubricated than one with the same load on it running more slowly. Some kinds of grease and oil are retained between bearings better than others. The same is true of metals. Brass and various other compounds retain the lubricant on their surface better than most pure metals. Very much also depends upon the attention given to journals and the appliances used for feeding the oil to them. Thus the bearings of the main connecting-rod of a locomotive have at times a pressure of from 2,000 to 3,000 lbs. per square inch, whereas the pressure on the journals of cars rarely exceeds one-tenth of that. In order to keep the crank-pins lubricated, it is necessary to give them the most constant and intelligent attention, to use the best lubricants and the most approved means of applying them. The pressure per square inch which can safely be put on a journal must therefore be determined by the attending circumstances. In the case of cars, these are so complicated, that only experience can work out the problem satisfactorily. In the consideration of this question, your committee have not undertaken to lay down any absolute theoretical rules to be universally applied, but they wish simply to recommend a size of axle which in their judgment would be best suited for all the varying circumstances of railroad traffic. In deciding on such a standard, it must be remembered that we must adopt such dimensions as will give good results, under all conditions, and not only under favorable circumstances,—that is when loaded with moderate loads, when provided with bearings made of good material, and lubricated with good oil, and carefully and faithfully attended to, when attention is necessary. With the present system of interchanging cars, the problem seems one

of providing a standard axle which will work well under the most unfavorable conditions. The standard axles should be such as would be the least liable to heat or break when overloaded, when the bearings and oil are of poor material, and the attention such as the most careless, ignorant and indolent inspector is sure not to give to them. Now if these are the conditions which must be fulfilled, a large journal is certain to do it very much better than a small one. By increasing the size of the journal the pressure per square inch with any given load is also diminished, and consequently with any given quality of brass or oil there is more certainty of having good lubrication and liability that the oil will be squeezed out from between the bearings.

It is of course true that by increasing the diameter of the journal the leverage of the wheel on the journal is diminished, and therefore more power is required to overcome the friction than would be needed if the journal were of small diameter. Now undoubtedly if it were possible to increase the surface of the journal by extending its length without enlarging the diameter, it would be better than to increase the diameter. But it is impossible to do this and retain the requisite strength and stiffness which an axle should have for safety and to wear evenly when the axle is of iron. Probably the substitution of steel for iron may enable the smaller journal to be extended in length, and yet be of sufficient strength. It is probably true that cars provided with axles having journals smaller than these recommended for the standard will require somewhat less power to draw them with moderate loads, if they are both thoroughly well lubricated. What is claimed for the large journal is that it is more certain to remain well lubricated in ordinary practice with the excessive weights with which cars are sure to be loaded at times, and when oiled with poor oil, and with the attention they receive on the long through lines. The advantage possessed by a large journal in this respect it is believed will much more than counterbalance the disadvantage of "increased leverage."

The increased resistance from the latter cause can be shown by a simple calculation. The resistance of a car, as nearly as it is known, is about 6.1 lbs. per ton of 2,000 lbs. at a speed of five miles per hour. Assuming that its weight is 20 such tons, the total resistance will be 122 lbs. This is made up of rolling friction of the wheels on the track and of the friction of the journals. Now if we take the coefficient of friction of the latter at 0.025, and deduct the weight of the wheels and axles, or 3,000 lbs., which does not rest on the journals, from that of the car, we find that the friction of the latter will be equal to 925 lbs.; which divided by the diameter of the wheels, 33 in., and multiplied by that of the journal, $3\frac{1}{2}$ in., will give the resistance at the tread of the wheel due to journal friction. By making the same calculation for $3\frac{1}{2}$ in. journals, we find that the resistance due to the small journals is 91, and for the large ones 105 lbs., or a difference of 14 lbs., or an increase of about 15 per cent. of the total resistance. But it must be remembered that the journal friction is uniform, or very nearly so, at all speeds, whereas the resistance to rolling, of the atmosphere and the flange friction increase very rapidly with the speed. These have been calculated from a table of resistance recently published, and are given in tabular form herewith. It will be seen that at a speed of 30 miles per hour the resistance is increased 6 per cent. by the large journal, at 40 miles per hour $4\frac{1}{2}$ per cent. The same thing will be true of the re-

Speed in miles per hour.	Total resistance of car weighing 20 tons of 2,000 lbs.	Resistance due to journal friction with $3\frac{1}{2}$ in. journal.	Resistance due to journal friction with 4 in. journal.	Percentage increase of resistance due to large journal.
5	122 lbs.	91 lbs.	105 lbs.	11 1/2 %
10	132 "	"	"	10 1/2 %
15	146 "	"	"	9 1/2 %
20	165 "	"	"	8 1/2 %
25	189 "	"	"	7 1/2 %
30	224 "	"	"	6 1/2 %
35	262 "	"	"	5 1/2 %
40	306 "	"	"	4 1/2 %
45	356 "	"	"	4 "
50	412 "	"	"	3 1/2 %
60	540 "	"	"	2 1/2 %

sistance on grades and curves. Thus, on a grade of 30 feet per mile and at a speed of 30 miles per hour the resistance of the car would be increased only about 3 per cent. by the large journal, and at the same speed on a grade of 40 feet per mile 2 1/2 per cent.

In these calculations we have assumed that the journals in each case were in a perfect condition of lubrication. If it is remembered that the friction of two surfaces which are only partly or very imperfectly lubricated is often from four to six times as great as it is when perfectly lubricated, it will be seen that a very slight difference in the condition of the journals and their bearings may increase the resistance very much more than that due to the enlargement of the journal. In other words, enlarging the journal increases the resistance of cars at ordinary speed of say 20 to 30 miles per hour from 8 1/2 to 6 1/2 per cent., whereas with imperfect lubrication the friction of the journals may be increased 600 per cent. The importance, therefore, of securing good lubrication is obvious. That this is more certain with the use of large journals is shown by the unanimous testimony of those who replied to the circular of your Committee and who had observed the effects of wear on the bearings of large and small journals. They are unanimous in the opinion that the bearings of the former wear better than those of smaller size.

Very great objection is, however, made to the adoption of a standard axle of the size recommended, owing to its great weight, which is about 335 lbs. finished. To this objection it is thought that the greater safety to life and limb which would result from its use would alone be a sufficient answer. The attention of those who say "that we never have any broken axles" is called to the report of such breakages contained in the 26 replies to the Committee's circular. It should be stated that with reference to this point the recollection of some of those who replied to the Committee's inquiry seemed to be as unreliable as that of some of the witnesses in the Beecher trial. It would nevertheless be an instructive practice in single rule of three to calculate the following "sum." If 26 master mechanics report 62 broken axles, how many could the 280 master mechanics given in the printed list before us. A printed list of train accidents in 1874, which doubtless most of you have seen, records 20 accidents from broken axles, and at least one member of your Committee knows how imperfect that report is. To say, then, that no accidents do occur from broken axles is to ignore well-established facts.

An additional reason for selecting the standard recommended by the Master Car Builders' Association and by your Committee is the fact that it has already been adopted by a number of roads, and large numbers of those axles are now in use. The Committee are unable to give a correct list of those roads which have put it in use, but are informed that the New York Central & Hudson River, the Boston & Albany, the Boston & Providence, and the Delaware, Lackawanna & Western, are using it. It will, of course, insure its general adoption very much earlier should it be recommended by your association, whereas if the two associations, which in this respect if in any should act harmoniously, should disagree, the time when uniformity of rolling stock can be secured will be indefinitely postponed.

Your Committee therefore recommend the adoption of the following resolution:

Resolved, That this Association concur with the Master Car-Builders' Association in recommending the adoption of the standard for car and tender axles which that Association has proposed when said axles are to be made of iron.

REPORT ON MECHANICAL LABORATORY.

This Committee, consisting of W. A. Robinson, of the Great Western Railway of Canada; Reuben Wells, Jeffersonville, Madison & Indianapolis; J. M. Boon, Pittsburgh, Fort Wayne & Chicago; N. E. Chapman, Cleveland & Pittsburgh, and H. M. Britton, Whitewater Valley Railroad, reported last year and was continued. In reply to a new circular of inquiry which it issued to all the members of the Association, it received comparatively few replies, and the Committee believe that "the subject is one for which the Association is not sufficiently matured at the present time to receive; for while six-eighths of the answers are in favor of the establishment of a mechanical laboratory, and five-eighths recommend it to be in connection with the Stevens Institute, yet six-eighths are not favorable to voting any of the funds of the Association towards such object, which thus practically means taking no action at all."

The Committee's communications with the American Society of Civil Engineers on this subject indicate that no action has been yet taken by that Society with regard to the proposition of the Stevens Institute to establish such a mechanical laboratory.

After a careful reconsideration, the Committee deem it the wisest course, at the present time, to recommend that this subject be postponed, either indefinitely, or until surer prospects exist of its being successfully carried out.

Contributions.

The New York Elevated Railroad—Some Details of a Novel Trestle-work.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The New York Elevated Railroad Company have lately adopted a wrought-iron supporting column consisting essentially of four cruciform struts, firmly seated in cast-iron sockets, which form the corners of a square, whose side, between their centers, is 14 inches. The socket casting is bolted to a foundation of masonry, and is so placed that its diagonals occupy, respectively, transverse and longitudinal planes of section. The struts slightly converge for about two-thirds of their height, where they are secured by means of connecting plates. From this point they curve outwardly, and are capped with plates, which form the sides and two principal diagonals of a horizontal irregular octagon, upon which the girders rest. The accompanying diagram, without attempt at representation of detail, shows the general form of this somewhat remarkable column. The support, at the points *a, a'*, is taken by means of cross girders. The general design and detail of this column are worthy of high commendation, but it seems pertinent to inquire why even greater efficiency and economy would not result in making the upper branches straight, instead of curved, and in arranging the columns to stand at an angle of 45 degrees with their present position.

1st. *Advantages which are common to both the present and the proposed position of the columns.*—Among the prominent advantages of the present form of column may be noted great length of bridge seat. It is evident that no rotation in a longitudinal direction can ensue so long as absolute contact between the bridge seats and the girders is maintained. This condition, which ordinarily, without the assistance of continuity of girders or longitudinal bracing, is difficult of realization in the construction of trestle-work, is in the present case perfectly simple because of the great length of bridge seat (virtually about five feet) available. In illustration of this principle, let it be supposed that a column or trestle 15 feet in height has a bridge seat one foot in length, and another of the same height a seat of five feet or two seats that distance apart. The top of the former can rotate $\frac{1}{30}$ inch from the vertical if the corners of its seat separate $\frac{1}{30}$ of an inch from the girders, while the corners of the latter will only separate 1-6 of an inch to admit of the same rotation. A rigid attachment of the girders seems to be required in the former case to prevent small oscillations; but in the latter no practical difficulty exists in seating the girders in chairs (one end of each girder being firmly attached, and the other fished to the fixed end of the adjacent span) in such manner as to allow expansion and contraction and at the same time maintain a considerably closer approximation to contact than 1-6 of an inch. This will leave little if any strain tending to produce longitudinal rotation to be provided for in the columns *per se*. Nothing need be lost in length of bridge seat, to which this condition is due, if the base of the column is placed at an angle of 45 degrees with its present position.

2nd. *Advantages which are peculiar to the proposed changed position of the columns.*—(a.) The principal object to be attained, by making the proposed change, is to place the columns in position of greatest possible lateral resistance—they being now in position of least resistance, in this respect. The same change will make the longitudinal resistance a maximum, although, as has been shown, no greater strength in this direction seems to be required. The present form of each column, or more correctly that portion of it below the point where the struts branch, may be likened somewhat to the case of two pairs of dividers, which, occupying vertical planes of right section, and being rigidly attached to each other at the top, have their legs equally spread and stuck into a board at the four corners of a square. A horizontal unbalanced force, acting at the top, in place of either pair of dividers, will develop, respectively, compressive and tensile resistance to rotation in but two of the four legs, while if the horizontal force be applied parallel to the sides of the square, which corresponds to the case of proposed changed position of columns, all the legs will oppose a resistance of either tension or compression. In the first case, it is true, the resistance acts with the leverage of the diagonal, and in the latter with that of the side of the square. The former is further assisted by the resistance to bending of the two legs which occupy the plane at right angles to the direction of the horizontal force. The strength of this

Co. It calls for the supposition of the heaviest locomotives, which, as you know, concentrate over 60,000 lbs. and as high as 80,000 lbs. on a wheel-base of 12 feet. The Springfield Bridge floor, however, is only constructed for less than 3,000 lbs. Nay, it is not only the floor; it is also the counterbracing of the Springfield bridge which is too weak. Also, the web is too light, and the concentrated load, instead of $3,000 \times 12 = 36,000$ lbs., should have been $6,000 \times 12 = 72,000$ lbs., or at least $5,000 \times 12 = 60,000$ lbs., if adopting the Phoenix specification.

Please, Mr. Editor, remember that the firm, Clarke, Reeves & Co., in the floor alone, by their estimate, have $7 \times 7,000 = 49,000$ pounds, more than in the Springfield bridge, equivalent to \$4,470, a sum by itself sufficient to make up for the difference in the tenders, not to mention the web system.

Has Mr. Philbrick acted as a just consulting engineer, bearing in mind the interest of his railroad, by which he is paid for conscientious services, when he made one specification for one party whose plan he likes, and another for the other parties whose plan he does not know how to appreciate?

Mr. Editor, please also read Mr. Philbrick's last letter of May 8, and notice his very innocent excuse for making this important change of the specification for the floor system:

"Such (15,000 lbs. on one wheel) was the original specification, and it was not modified in the interest of the contractor."

I here object, and assert it is impossible to assume that it was not known to Mr. Philbrick that such change must be in the interest of the contractor, for every engineer of moderate experience and knowledge knows the great difference as regards strength and cost, and Mr. Philbrick, who gets up the details of the small bridges of the Boston & Albany Railroad in his office, does undoubtedly know it, and as consulting engineer of that great road he must know it.

Mr. Editor, please read what further this gentleman brings as excuse:

"I had, when writing [contradicting my statement] forgotten (1) that a subsequent (1) modification was made, but I find on referring to my notes that I did modify (1) it, not to lessen cost (1) to the contractor, but to dispose of the iron in a way which I considered (1) more to the advantage of the structure, viz.: by doubling up the lateral bracing at the ends of the spaces, and applying additional iron in other places where the specification did not require it."

This excuse is but a too thinly veiled contempt for the understanding of the readers of the *Railroad Gazette*.

Where did Mr. Philbrick put that material? In the top chords, perhaps, where over 30 per cent. is still wanting.

We have seen that the lateral bracing of the Springfield bridge is simply miserable, and Mr. Philbrick's duty it would have been to compel the contractor to put enough material in the proper shape in top and bottom laterals and in the top struts, without even cutting an ounce from the material prescribed for the floor, so much the more so if he remembered his proceedings at the time of the letting.

So much on what Mr. Philbrick calls "the unfairness of Mr. Bender's criticisms" on these points.

I have stated (and was contradicted) that the height of the truss was previously fixed upon, thus imposing an onerous discrimination in favor of lattice bridges. My statement is true; Mr. Philbrick's denial was not. Please, Mr. Editor, find evidence thereof in Mr. Philbrick's own letter to Mr. Clarke.

Mr. Hilton says lattice bridges economically can be built higher than pin-jointed bridges, because the manner in which the diagonals are connected with the struts enables the designer to maintain a practically constant ratio of width of compression member to its length. Very well, if only that manner of connecting were not illegitimate.

I should have designed the 180-foot spans of the Springfield Bridge with but two trusses, 30 feet deep, divided into ten panels of 18 feet each, and I am sure I should have obtained a more economical web than by the lattice plan, at least if properly designed in the details. But Mr. Philbrick also had (I suppose privately) specified the panel length at 12 feet, and thereby had just reached that free bearing length of the compression diagonals of 8½ feet, which I understand to be the length preferred by the lattice builder, so as to use still 7,000 lbs. of pressure per square inch. An increase of the depth of a quadrangular truss, without increase in the length of the panels, increases the cost of the web, so as to almost annihilate the gain in the chords.

The Springfield lattice bridge has a light web also on account of defective connections of over one-half the number of the diagonal ties and struts made of single angles. These angles, namely, are only connected to the vertical 12-in. plates of the chords by rivets in but one of the legs of these angles; thereby the center lines of gravity of rivets do not coincide with the line of gravity of the angles, and moments are originated which increase the strains from 16 to 20 per cent. (see Professor Callcott Reilly's Studies on Girder Bridges.)

So far as the quality of the tensile material is concerned, which with the adoption of the Phoenixville specification should have been double refined—this also being the specification for first-class bridges in Europe, both for tensile and compression members, for angles as well as for plates. I learn from the makers of the angles for the Springfield lattice bridge that only the usual merchant angles were ordered, and that they never received an order for double-

refined angles but once, for Government gun-boats, though numerous orders of angles for lattice bridges are received.

The makers of those angles were the Phoenix Iron Works. Such angles do not stand strains of 55,000 to 60,000 lbs.; do not extend over 8½ per cent., and do not allow cold bends over 45 degrees. (See Mr. Griffen's valuable paper, American Society of Civil Engineers, June, 1872.)

Double-refined iron costs more than "best" iron, namely, about ¾ cent per lb., and therefore only few bridge-builders (the first-class bridge firms of this country) will use it.

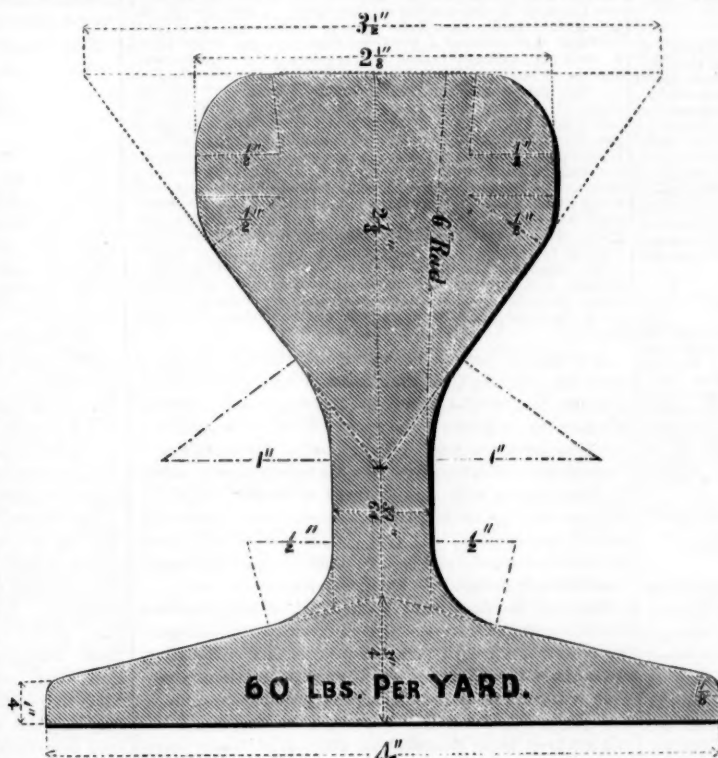
By Mr. Bartlett's notes we were informed that the compression strain for the Springfield Bridge was specified at 8,000 lbs. per square inch. This figure, as we know, came from Mr. Philbrick's office. One of the bidders on the bridge calculated on 8,000 lbs. per square inch, and told me that he had got this figure in Boston, where he went for the specification.

The figure of 8,000 lbs. is also the usual specification for compression members of English lattice bridges.

I am in possession of working drawings from Mr. Philbrick's office designed for a small bridge on the Boston & Albany Railroad which contains Mr. Philbrick's specification for such structures, viz.: Live load, 3,000 lbs.; special load on driving wheel, 15,000 lbs.; top-chord pressure, 8,000 lbs.; bottom-chord tension, 9,000 lbs.; struts, 7,000 lbs.

But Mr. Philbrick has informed us that Mr. Bartlett's figure (copied from working drawings in Mr. Philbrick's office) of 8,000 lbs. is not correct, but that he specified 9,000 lbs. for the Springfield Bridge.

Now, suppose this was the specification, was it correct to pre-



Rail Section Used on the Cincinnati Southern Railway.

scribe Gordon's formula to one party and not exact it from the other, the more so if the length of 12 feet of the very improperly shaped top chords of the Springfield Bridge on the average requires the supposition of strains of even less than 8,000 pounds?

By this discrimination, which, to excuse Mr. Philbrick, I supposed to be traced to an oversight on his part, the lattice builder saved about 30 per cent. of material in the top chords.

The fault of the construction, in fact, consists in using wide meshes and still applying the same ineffective shape of top chord that is used more legitimately in lattice bridges whose panels are only five to six feet long.

In the Springfield and similar lattice bridges, therefore, the web is made light at the expense of the top chords.

It is hardly necessary to mention that I have proved, so as to make the question understood by school boys, that the connections of the Springfield Bridge, instead of being strained to the prescribed 10,000 lbs., are actually strained from 13,300 to even 17,000 lbs., thus reducing the value of the bridge to 10-17th, or to 58 per cent. of the prescribed strength.

I shall not blame Mr. Philbrick nor Mr. Hilton for their errors in this regard, for with few exceptions (standard drawings of a few Austrian roads; also, compare Prof. Reilly's studies on Iron Girder Bridges, also Minutes of Proceedings of Institute of Civil Engineers, Vol. XXII.), these errors can be found in the majority of lattice designs.

It was originally solely my intention to bring these defects to the notice of the members of the profession.

But for the hard words thrown at me, I should not have been compelled to follow the Springfield Bridge up to its other defects.

Mr. Editor, I can now quietly leave the material before the readers of your paper, to their and to your own judgment.

You may now judge whether there is a shadow of truth and justice in Mr. Hilton's attack, when he says: "I am content to let it rest there until the charge is repeated by one whose habit of careful adherence to facts in making statements is so well established as to render it worthy of further notice." I think Mr. Hilton will do well to apply this censure to his friend Mr. Philbrick. It has no bearing on me.

Whether Mr. Philbrick has added a new step to the Olympus of his high standing by his participation in the award and execution of the contract of the lattice bridge at Springfield, I shall not longer dwell on; but I feel as if Mr. Hilton has not by any means put up for himself a monument by his design of this lattice bridge, defective as it is in the joints, by as much as 43 per cent., weak as it is in the top chords by 30, in the web by 16 to 20, in the floor and counterbracing by 40 per cent., not to speak of its miserable lateral bracing, nor to mention the faulty plan in its totality.

Mr. Editor, will you please now to inform me what more facts you want, to be convinced, and will you please also to let me know what other contradiction has not been cleared up by the facts I have brought you.

Perhaps you will be kind enough this time to admit that Mr. Philbrick's contradictions were without foundation.

CH. BENDER.

Specifications for Sixty-Pound Iron Rails.

The following specifications and the engraving are those adopted by the Cincinnati Southern Railway, in inviting bids for iron rails for its road:

General Clause.—The weight of the rail is to be sixty pounds per lineal yard of rail. The rail must be in every respect according to tracing and template and of uniform section throughout the whole length. The maximum allowance to be admitted in the sectional dimensions must not exceed one forty-eighth of an inch.

File and Mode of Manufacture.—The piles for the rails must be composed in weight of 35 per cent. of the best crystalline hammered iron for the head; 30 per cent. of good sound puddled bars, rolled from hammered blooms, for the stem; and 35 per cent. of the best fibrous iron for the bottom flange. The top and bottom slabs are to be of the same length and width as the pile; the other slabs must all lay flat, breaking joint laterally and of the same length as the pile.

No short pieces will be allowed in the pile. The pile must be heated in the furnace with the part corresponding to the top of the rail up; it must first be hammered under a five-ton hammer, or compressed in rolls at a slow motion to secure a thorough welding of all parts; reheated and then rolled.

Outing of Ends.—The ends must be cut square with the axis of the rails, and must show a smooth surface, clean, compact, and without defect.

Straightening.—The rails must be straightened on the four sides while hot. The straightening is not to be made by percussion, but by screws or cams. Reheating any part of the rail will not be allowed. The surface of the rail must be smooth and without any defects, such as cracks, blisters, welding seams, etc. No patching of defects will be allowed.

Drilling and Punching.—The rails must be punched or drilled at the ends in accordance with the tracing, the allowance tolerated in the dimensions of the holes or notches and the distance between them must not exceed one thirty-second of an inch. The holes must be cylindrical and punched or drilled so as not to show any projection beyond the uniform surface of the rail.

Length.—The rails must be 30 feet in length each. Ten per cent. of their numbers will be allowed of shorter length down to 24 feet, but they must all be of an even number of feet, and must not vary therefrom more than one-eighth of an inch.

Weight.—An allowance of 2 per cent. each way for individual rails and of 1 per cent. each way for the whole quantity of rails received, will be made in the weight. If too light, the rail will be rejected; if too heavy, it will be accepted at the nominal weight, with the 2 per cent. allowance added.

Marking.—Each rail must be marked about two feet from the ends with the maker's mark and the year and month in which it was rolled; the letters and figures must be distinct and not less than one inch in height.

Every approved rail must be marked with the Inspecting Engineer's private stamp, otherwise it will not be accepted.

Inspecting and Testing.—The rails will be inspected by an engineer in lots of 1,000 bars. Five rails out of a lot will be selected by the Inspector and submitted to the following tests:

Each of the selected rails must carry 7½ tons in the center between bearings, four feet apart in the clear, for five minutes, with a deflection not exceeding one quarter of an inch, and must come back to its original line when the weight is removed, within 1-100th of an inch.

In the same position, the rails must carry 15 tons in the center between bearings for five minutes without breaking. The rail will then be broken in two and each half submitted to one blow of a hammer weighing 600 pounds, and falling six feet vertically. The bearings for the rails must be four feet apart in the clear, and made of cast iron, fastened on oak frames supported by stone pillars with solid foundations at least three feet below the surface. The section of the broken rail must show a clean and compact metal throughout, free from cinders, welding seams or other imperfections denoting impurity or imperfect welding. The head of the rail must show on top at least three-quarters of an inch of small grain, hard iron; the bottom flange of the rail must show all fibrous iron; and the remainder of the section a gradual mixture of grain and fibre.

Should one of the rails fail under any of the foregoing tests, five more will be selected out of the same lot and similarly tested; if more than ten rails have failed, the whole lot of 1,000 bars to which they belong will be rejected. The Inspecting Engineer will have free entry to the works, and full power to inspect the manufacture, at any time, to satisfy himself that the rails are being made in accordance with the stipulations of this agreement; any remark which he may have to make will be addressed to the manager of the works, and not to the workmen.

Certificate.—A certificate will be delivered by the Inspecting Engineer for each lot of rails approved and stamped. No part of the work will be done by any other manufacturer without the express consent of the Trustees.

Guarantee.—The rails will be guaranteed for three years after laid in track. The value of all rails which within that period of time will show material signs of imperfections or weakness will be refunded to the Trustees at the rate of \$25,000 per ton, the rails remaining the property of the Trustees. This clause will not apply to rails laid within 1,000 feet of stations or in yards.



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Editorial Announcements.

Addresses.—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed EDITOR RAILROAD GAZETTE.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

THE MASTER MECHANICS' CONVENTION.

According to the announcement, the convention of the Master Mechanics' Association assembled at the Cooper Institute in New York on Tuesday last. On Monday evening the arrival of members at the St. Nicholas Hotel indicated the approaching meeting, and the flitting to and fro of committee men was the shadow of the hospitality which the New York merchants and manufacturers had in preparation for the members of the Association. On another page we publish abstracts of most of the reports. These as a whole, it is believed, are fully equal to those of previous years in interest and value. The subject which, up to the time of writing, Wednesday afternoon, attracted most attention, was that of the use of steel for fire-boxes. The discussion of this subject was very extended, and certainly ought to lead to some good results, or at least induce the members to observe more closely the action of steel in use in locomotive boilers. Those who gave in their evidence were almost unanimous in their testimony that steel fire-boxes are very liable to sudden fracture when in use. The theories in regard to the cause of their fracture almost all broke down under cross-examination, and the tests to determine whether steel would stand or not, when the experience of one member was compared with the other, nearly all proved valueless. The result of the discussion was therefore only to determine the limits of the ignorance of those who took part in it, which is often the first and a very important step in acquiring knowledge. That the discussion will be in every way an extremely profitable one there can be no doubt, and that it will be of ultimate benefit to steel manufacturers and will result in profit to all parties concerned we are also equally certain.

The discussion of Mr. Barnaby's paper on "Iron and Steel for Shipbuilding," which was read before the Institution (British) of Naval Architects and from which we quoted last week, revealed the fact that the trouble with steel plates is not confined to this country, but that English and also French engineers share with us the difficulties which the report and the discussion on the "Best Material for Boiler Construction" indicated to be so serious an evil and drawback to the use of steel for locomotive fire-boxes. As reference was made to European practice, the following quotation from Mr. Bessemer's remarks during the discussion on Mr. Barnaby's paper will probably have very

great interest to those who were, as well as to those who were not, present at the Convention:

"The London & Northwestern Railway Company have applied this material (Bessemer steel) on their line to almost every purpose. At first they commenced with the rails. They doubted the propriety of using it for tires, but a little experience convinced them that it was the right thing for tires. It was said it could not be used for axles, but in that respect also the excellent manufacture of the Low Moor Iron Works, for it is an excellent manufacture, had to give way to Bessemer steel, and vast numbers of those have been for years and years in use, not giving way as readily as iron, and wearing four or five times the length of time. The point which touches most on Mr. Barnaby's paper is its use as a riveted material. Long after the railway company had begun to find out how exceedingly durable and strong it was, they ventured to apply it for boilers of locomotives. I need not tell you that in the construction of locomotive boilers there are a great many difficult bends, and it requires a great many hammerings, and whatever the French gentleman may say as to constructing those French ships of war, I have never in my life seen a copper hammer applied to a piece of Bessemer steel. The boilers made at Crewe are punched by the ordinary punching machines in the usual way. I am told that they lose in strength in punching about one-third, and that on annealing the whole of that one-third is restored. Therefore when you have to deal with materials requiring that specific treatment, I think it is most unfair that we should be asked to judge of it unless that treatment is followed out. I have before me a number of samples of Bessemer steel which have holes $\frac{1}{4}$ in. in diameter punched in them, and drifted out with a big wedge driven by the heavy blows of an iron hammer until they assume these sizes. These samples are the standard that has been adopted on the London & Northwestern line; and that is the test to which every one of the plates that go into their boilers is subjected. Two pieces are cut off, one is subjected to this dreadful punching process, and the other is bent in the way in which you see some of the samples on the table. These are not the wonderful samples I could show you of doubled up iron or steel, but that is considered a good practical test for every plate. I am not giving these as specimens of what steel can be brought to, but I asked them to send me stamped as they are from their great depots samples of all the plates they have ever used—half-a-dozen of each—to lay before you. The letter accompanying these samples tells me that they have got 11,000 of these samples by them, cut from 11,000 plates worked by the London & Northwestern Railway Company into locomotive steam boilers. They tell me that they have at this moment over 300 locomotive engines running, and doing their daily and regular work, all built of punched Bessemer steel plates. Not only so, but they are entirely superseding the iron plates which they formerly used, and for which purpose they brought all the best iron that could be bought in the country at the time; and the London & Northwestern Railway Company at this moment are making for themselves rather more than six locomotive boilers every six days, so that the average amount of work exceeds one locomotive boiler per day."

It would, of course, be extremely interesting to know what the experience of the London & Northwestern Railway has been with the use of Bessemer steel; that is, whether they experience the same difficulty from the sudden fracture or cracking of the plates of fire-boxes that is so common in this country. We cannot speak with entire confidence as we write, but we think we are correct in saying that very few or no Bessemer metal boiler plates are used in this country. If that kind of plate is free from the sudden fractures of which so much complaint is made, it certainly is desirable to know the fact.

Although the discussion resulted in nothing but what might be called negative conclusions, unless we except a perceptible leaning in favor of experiment with corrugated plates for fire boxes, yet it would have been impossible without such a meeting of the master mechanics to have presented so forcibly the extent and nature of the evil referred to to the minds of those most deeply interested as the report and discussion of a few hours did to those who were present. When, therefore, persons disposed to sneer and cavil at the Master Mechanics' Association ask "what does it all amount to?" it may be said very truly, that this year it has amounted to this, if nothing else, that it has given to master mechanics a clear and distinct idea of the extent of an evil which is costing railroad companies thousands of dollars annually, that it has taught them that many of their cherished theories are unsound, that the tests employed to determine the quality of the material used in boilers are almost entirely valueless, and that they must institute new enquiries, try other experiments and probably different modes of construction to cure the evil complained of. The mind of every member who was present at the Convention, and probably of most of those who will read the discussion, will from this forth be led to make a closer diagnosis of the disease and to seek, if not a specific, at least a prevention of it.

The general character of the reports can be learned from the abstracts given of them on another page. The attendance at the meeting this year, it is thought, is quite equal to that at previous meetings, and the interest is also fully as great.

A very interesting event was the visit of the venerable Peter Cooper to the meeting on Wednesday, and his account of the construction of his first locomotive, and the almost boyish glee with which he related, as a good joke, that the cause of failure on one occasion was owing to the theft of the copper steam-pipes, which were stolen for the value of the copper, is an event which all enjoyed and must always be remembered with pleasure by those who were present.

The merchants and manufacturers of New York took steps some weeks ago to afford some entertainment to the members of the Association during their stay in New York. On Tuesday evening they all attended the Fifth Avenue Theatre. For the evening of Wednesday a musical enter-

tainment is proposed for the ladies who are in New York with the members. This is intended for their enjoyment while the members are engaged at an evening session. For Thursday afternoon a ride to Central Park is arranged, and for Friday a sail up the Hudson and around the harbor of New York. All this is managed very quietly, and what may be called the hospitality organization is very complete, and works without any perceptible jar or noise.

New York, however, presents so many attractions to members that the attendance at the meetings is not quite so regular as it would be were there not so much else to occupy the attention of strangers here.

From present indications, it seems then that the eighth annual convention of this Association will fully sustain the reputation earned in the past, and that the promise of usefulness which it holds out for the future is such as to merit from the owners and managers of railroads every encouragement and assistance. That the Association is all that such a society might be is of course not true, but it does the work which it has undertaken to do in a business-like way, and even if it did nothing more, the proceedings are very fertile in suggestions which produce that sort of interrogative state of mind the importance of which very few of us estimate at its true value. In this way, then, annual conventions become intellectual seed times, and many a germ is carried away which will take root and yield a harvest, possibly after many days which may then not be recognized as the result of the cultivation which it is the office of the Master Mechanics' Association to direct and administer.

THE GERMAN RAILROAD UNION.

We have frequently made mention of this association and of its organization and method of working, as doubtless our readers remember; but at this time, when our own technical associations are holding their yearly meetings, and our attention is drawn to them and their efficiency and the best methods of increasing it, it is worth our while to learn what has been done elsewhere by similar societies.

The German Railroad Union, it is true, is in many respects dissimilar to our associations of engineers and railroad officers, however similar it may be in its aims and in some of its methods. The most striking distinction is that it is not an association of individuals but of companies or managements (there being a large number of State railroads in Germany the two terms do not mean the same thing there.) The literal title of the organization is "The Union of German Railroad Managements." One effect of this, which we need not discuss here, is, that the Union is able to make and carry out business agreements among companies with an ease and a success wholly unknown here; though the determinations of the Union are not, as might be supposed, made binding on all its members, but, we believe, only on those which consent to them, except when they have once been unanimously approved, when they may not be departed from again. But aside from such business affairs, this organization makes a striking difference in the method and the success of the Union in the collection of information, the investigation of facts, and the compiling of reports and papers on the subjects which demand its attention. Technical questions are reserved for a sub-division of the Union, under the direction of a "Technical Commission." Now this Commission being appointed by the associated companies, including nearly all the managements in Germany and Austria and some in adjoining countries, naturally feels under a responsibility for its work. The method of proceeding is singularly like that of our Master Mechanics' and Master Car Builders' Associations, in that questions are prepared for examination and discussion a long time previous to the convention, are sent to all the companies in the Union for replies or suggestions, and that from the material so collected the reports are made which are presented for discussion at the technical conventions, and are then sometimes the subject of resolutions when uniformity of action is aimed at. The German "Technical Commission," however, plays a more important part than any officers or committee of any of our American societies. It is a comparatively large body—there are eighteen members—more permanent than most officials in American societies, and has the initiative in presenting questions, and the direction in collecting and compiling information and reporting on them. For this Technical Commission prepares the questions which are to be discussed and what corresponds to the circulars of inquiry sent out by our Master Mechanics' and Master Car-Builders' associations, receives itself the replies made thereto, and has the report on each prepared by one of its members, appointed Reporter for that special subject. It is this body, too, which prepares the publication corresponding to our annual reports of proceedings.

Now when an inquiry comes from this Technical Commission, it is directed, not to an individual master mechanic, or engineer of road, or traffic manager, but to the railroad company or management, and the latter appoints

one of its officers to prepare a reply. Thus the duty comes upon the railroad officer as imposed upon him by his superiors—as much to be attended to as any other, and there is no question as to whether his conduct will be approved if he spends some time at it. He is not a member of the Union. His company is the member, and it disposes as best it may of its officers in doing the work for the Union. Some of the replies thus prepared, which we have seen in print, were elaborate, and evidently made with a great deal of labor and by the aid of long continued records of special experiences. These were probably exceptional, but it is still true that a man has a task given him by his employer he is both more likely to attend to it and more likely to take pains to do it well—especially if he is a very busy man and anxious not to waste his employer's time—than if this service was one with which his company has nothing to do and may never hear of.

The collection of information often requires that a new system of keeping accounts of some things should be instituted. Few railroad officers feel justified in making (or asking, if it is a matter beyond their control) such a change, if it affects any other department than their own, on the request of some association. But the German Technical Commission presents its requests in the name of the associated railroads of Germany, to a company which is a member of that association, which is the sole agent for effecting many important agreements of different kinds, and of introducing uniformity in essentials of road and rolling stock and methods of doing business.

Among the results of this association are a series of uniform technical regulations concerning the construction of railroads, rolling stock, and the mode of working the railroads of the Union, which we translated and published about a year and a half ago. These are not intended to cover everything, but only those points in which uniformity seems desirable. There are hundreds of points covered by these regulations, however. But they cover only a small part of the work of the technical side of the Union. Investigations are made of matters in which uniformity of practice is not sought, just as our societies do, for mutual information and for the sake of advance in the art of railroad transportation. Recently we find announced in German papers a volume called "The Technical Progress of the German Railroads," which corresponds somewhat with the annual report of our Master Mechanic's Association. It covers a wider field, however, including as it does the whole field of constructing and working railroads as well as rolling stock. The last issue of this publication is based on the proceedings of the last "technical convention" of the German Railroad Union, which was held in Dusseldorf, on the 14th and 15th of September last. This publication is issued in quarto form, with pages about two-thirds the size of those of the *Railroad Gazette*, and is illustrated by lithographic plates. The last issue has about 175 pages and is not given away, but sold for about two dollars, gold. This is the fifth issue of the kind; but it is by no means the fifth year of the Union, which, indeed, is older than most of our railroads. The "technical convention" is a later development of the Union, but is still quite old. It is not held yearly, however, but at irregular intervals, as may be thought best. All the work of the convention is most carefully elaborated before it meets, and the volume published is not a simple record of all the convention proceedings, but a carefully edited statement of whatever may be thought to have permanent value. The first of these publications was based on the results of a convention held in Dresden in 1865, and was accompanied by an appendix volume giving accounts of all the iron bridges on the railroads of the Union (including nearly all in Germany and many others) of more than 50 feet span, with dimensions, weights, tests, etc. The second publication was not based upon any convention proceedings, but was compiled from official communications sent by the railroad companies of the Union to its "Technical Commission," by an engineer of extraordinary acquirements in all the technical details of railroads—Mr. E. Hensinger von Waldegg, whom we may almost call the regularly commissioned author for the Union, so far as its technical side is concerned. This second issue was devoted to "The Latest Improvements in Railroad Superstructures," and contained an enormous number of plates, and was accompanied by a supplementary volume wholly of plates. The third issue was based on a convention held in Munich in 1868. With it was published a supplement which has become the standard source of information on continental locomotives. It contained outlines and the principal dimensions of all the locomotives which had been made by railroads in the Union during the five years previous. The fourth issue was a collection of approved ground plans of railroad station and switching yards in use on railroads of the Union.

The official and authoritative character of the German society is something which, whether desirable or not, cannot be imitated by any of our American societies, simply because they are societies of individuals and not of com-

RAILROAD EARNINGS, YEAR 1874.

Name of Road.	Mileage.					Earnings.					Earnings per mile.				
	1874.	1873.	Inc.	Dec.	Per c.	1874.	1873.	Increase.	Decrease.	P. c.	1874.	1873.	Inc.	Dec.	P. c.
Allegheny Valley.....	219	139	80	.....	57.6	\$2,388,472	\$2,097,238	291,234	.....	13.9	\$10,911	\$19,408	.....	8,494	43.8
Atchison, Topeka & Santa Fe.....	507	501	6	.....	1.2	1,252,426	1,240,249	12,177	.....	1.0	2,470	2,476	.....	6	1.2
Atchison & Nebraska.....	150	150	.....	.....	.....	353,305	372,655	19,350	.....	5.2	2,380	2,484	.....	104	4.3
Atlantic & Gulf.....	346	346	.....	.....	.....	1,032,256	1,005,947	26,309	.....	2.6	2,953	2,907	.....	46	1.6
Atlantic & Pacific.....	328	328	.....	.....	.....	1,360,978	1,276,311	84,667	.....	6.6	4,149	3,891	.....	258	6.6
Belvidere Delaware.....	80	80	.....	.....	.....	1,215,648	1,148,223	67,425	.....	5.9	15,196	14,353	.....	843	5.9
Burlington, Cedar R. & Minn.....	424	387	37	.....	18.8	1,246,911	1,180,322	66,589	.....	5.6	2,941	3,006	.....	65	2.2
Camden & Atlantic.....	67	67	.....	.....	.....	529,387	504,996	24,391	.....	4.8	7,909	7,597	.....	312	4.1
Central of Iowa.....	190	190	.....	.....	.....	618,669	618,062	607	.....	0.1	3,263	3,253	.....	10	0.3
Central of New Jersey.....	293	293	.....	.....	.....	8,889,631	8,881,366	8,265	.....	0.1	30,316	30,311	.....	5	0.0
Central Pacific.....	1,266	1,218	48	.....	3.9	14,405,479	13,872,732	532,747	.....	3.9	11,879	11,390	.....	489	4.3
Chartiers.....	23	23	.....	.....	.....	71,150	61,293	9,857	.....	16.1	3,094	2,665	.....	429	16.1
Chicago & Alton.....	649	649	.....	.....	.....	5,125,223	5,497,541	372,318	.....	6.8	7,899	8,471	.....	572	6.8
Chicago, Burlington & Quincy.....	1,264	1,264	.....	.....	.....	11,405,318	11,405,226	92	.....	0.0	9,213	9,223	.....	10	0.1
Chicago, Danville & Vincennes.....	157	142	15	.....	10.6	745,064	696,726	48,338	.....	6.9	4,746	4,907	.....	161	3.3
Chicago, Milwaukee & St. Paul.....	1,399	1,384	15	.....	1.1	9,963,017	9,046,124	916,893	.....	10.1	7,143	6,506	.....	637	9.8
Cleve., Col. & Ind. & Erie.....	471	471	.....	.....	.....	4,248,606	4,887,449	638,843	.....	15.1	9,011	10,366	.....	1,355	15.1
Cleve., Mt. Vernon & Delaware.....	145	127	18	.....	14.2	445,800	355,325	90,475	.....	25.5	3,039	2,798	.....	241	8.6
Cleveland & Pittsburgh.....	199	199	.....	.....	.....	2,072,556	3,671,738	1,600,182	.....	69.0	10,407	18,451	.....	8,044	77.7
Col. & Ind. Central.....	587	587	.....	.....	.....	3,865,832	4,447,807	581,975	.....	15.1	6,582	7,577	.....	995	15.1
Columbus & Hocking Valley.....	89	89	.....	.....	.....	717,491	1,074,187	356,696	.....	50.0	8,062	12,070	.....	4,008	50.0
Denver & B. Grande, Main Line.....	120	120	.....	.....	.....	376,959	392,504	15,545	.....	4.2	3,141	3,271	.....	130	4.2
Det., Lansing & Lake Mich.....	184	181	3	.....	1.7	807,697	709,732	97,965	.....	13.8	4,390	3,921	.....	469	11.9
Detroit & Milwaukee.....	189	189	.....	.....	.....	1,151,207	1,204,877	53,670	.....	4.6	6,091	6,375	.....	284	4.6
Erie & Pittsburgh.....	84	84	.....	.....	.....	872,613	1,165,298	292,685	.....	33.4	10,460	13,956	.....	3,496	33.4
Galvan, Clinton & Springfield.....	111	111	.....	.....	.....	262,490	253,315	9,175	.....	3.6	2,375	2,282	.....	93	4.0
Illinois Central.....	1,109	1,109	.....	.....	.....	7,947,855	8,334,594	386,739	.....	4.8	7,167	7,515	.....	348	4.8
Indianapolis, Bloom. & West.....	344	326	18	.....	5.5	1,635,683	1,532,242	103,441	.....	6.8	4,730	4,500	.....	230	5.1
Indianapolis, Cin. & Lafayette.....	179	179	.....	.....	.....	1,820,153	1,891,363	71,210	.....	3.9	10,168	10,560	.....	392	3.8
Indianapolis & Vincennes.....	117	117	.....	.....	.....	274,596	274,596	0	.....	0.0	2,347	2,109	.....	238	11.3
International & Gr. Northern.....	430	371	59	.....	15.9	1,309,574	990,375	319,199	.....	32.2	3,045	2,669	.....	376	14.1
Jeff., Mad. & Ind.apolis.....	225	225	.....	.....	.....	1,487,577	1,487,577	0	.....	0.0	6,594	6,389	.....	205	3.2
Knox & Lincoln.....	49	49	.....	.....	.....	161,509	141,720	19,789	.....	14.0	3,297	2,892	.....	405	14.0
Lake Shore & Mich. Southern.....	1,175	1,154	21	.....	1.8	17,146,131	19,414,509	2,268,378	.....	11.7	14,592	16,824	.....	2,232	15.7
Lawrence.....	22	22	.....	.....	.....	174,643	189,339	14,696	.....	8.3	7,938	8,608	.....	670	8.3
Little Miami.....	107	107	.....	.....	.....	1,448,086	1,401,648	46,438	.....	3.3	7,351	7,114	.....	237	3.3
Maine Central.....	356	356	.....	.....	.....	2,094,081	2,098,078	3,997	.....	0.2	5,882	5,890	.....	8	0.1
Marquette & Cincinnati.....	287	287	.....	.....	.....	2,094,511	2,126,878	32,367	.....	1.5	7,398	7,469	.....	71	1.0
Missouri, Kansas & Texas.....	786	716	70	.....	9.8	3,150,735	4,444,321	1,293,586	.....	41.1	4,000	6,347	.....	2,347	58.3
Mo. River, Ft. Scott & Gulf.....	161	161	.....	.....	.....	893,400	707,989	185,411	.....	20.9	5,549	4,397	.....	1,152	26.3
Mobile & Ohio.....	527	521	6	.....	1.2	2,301,019	2,801,127	500,108	.....	21.7	4,337	5,376	.....	1,039	23.8
New Castle & Beaver Valley.....	15	15	.....	.....	.....	392,319	351,089	41,230	.....	11.7	2,644	2,353	.....	291	12.4
New Jersey Southern.....	176	176	.....	.....	.....	513,655	745,794	232,139	.....	45.3	2,918	4,237	.....	1,319	45.3
Northern Central.....	320	317	3	.....	0.9	4,676,500	5,031,366	354,866	.....	7.6	14,614	15,879	.....	1,265	8.4
Ohio & Mississippi.....	393	393	.....	.....	.....	3,632,099	3,632,099	0	.....	0.0	9,242	9,209	.....	33	0.4
Oil Creek & Allegheny River.....	123	123	.....	.....	.....	846,882	1,067,734	220,852	.....	26.2	6,885	8,681	.....	1,796	25.7
Pacific of Missouri.....	410	471	61	.....	15.0	3,802,977	3,707,942	95,035	.....	2.6	9,276	7,872	.....	1,404	17.8
Pennsylvania, Main Line.....	519	511	8	.....	1.6	2,343,040	2,306,492	36,548	.....	1.6	4,516	4,504	.....	12	0.3
Pennsylvania, Branches.....	288	288	.....	.....	.....	3,506,919	3,842,067	335,148	.....	8.7	12,177	13,340	.....	1,163	9.4
Philadelphia & Erie.....	201	201	.....	.....	.....	3,373,316	3,841,314	467,998	.....	13.9	17,778	19,111	.....	1,333	7.6
Pitts., Ft. Wayne & Chicago.....	408	408	.....	.....	.....	8,899,472	9,019,074	119,602	.....	1.3	21,375	20,554	.....	821	3.8
Pitts., Virginia & Charleston.....	30	30	.....	.....	.....	137,890	66,966	70,924	.....	106.6	4,597	2,332	.....	2,265	106.6
Quincy, Missouri & Pacific.....	70	70	.....	.....	.....	107,151	92,739	14,412	.....	15.5	1,531	1,326	.....	205	15.5
Rome, Watertown & Ogdens.....	218	218	.....	.....	.....	1,192,868	1,194,513	1,645	.....	0.1	5,517	5,479	.....	38	0.7
St. L., Alt. & T. H., Main Line.....	195	195	.....	.....	.....	1,254,137	1,368,052	113,915	.....	9.1	6,431	7,019	.....	588	8.6
St. L., Alt. & T. H., Branches.....	71	71	.....	.....	.....	639,347	637,486	1,861	.....	0.3	8,778	8,718	.....	60	0.7
St. L., Iron Mt. & Southern.....	561	449	112	.....	19.8	3,262,680	2,539,538	723,142	.....	28.5	5,816	5,418	.....	398	7.4
St. Louis & Southeastern.....	349	349	.....	.....	.....	1,258,754	1,294,498	35,744	.....	2.8	3,607	3,709	.....	102	2.8
St. Paul & Sioux City.....	122	122	.....	.....	.....	545,190	539,834	5,356	.....	1.0	4,468	4,423	.....	45	1.0
St. Paul & St. Paul.....	148	148	.....	.....	.....	281,115	224,688	56,427	.....	25.0	1,899	1,518	.....	381	25.0
South Carolina.....	242	242	.....	.....	.....	1,365,972	1,491,016	125,044	.....	9.0	5,645	6,161	.....	516	9.0
Toledo, Peoria & Warsaw.....	236	237	1	.....	0.4	1,063,118	1,224,808	161,690	.....	15.2	4,505	5,168	.....	663	15.2
Toledo, Wabash & Western.....	628	628	.....	.....	.....	4,997,729	5,738,907	741,178	.....	14.9	7,968	9,138	.....	1,170	14.9
Union Pacific.....	1,032	1,032	.....	.....	.....	10,689,880	10,266,104	423,776	.....	4.1	10,292	9,948	.....	344	3.4
United New Jersey.....	276	276	.....	.....	.....	8,790,969	8,516,740	274,229	.....	3.2	31,525	30,856	.....	669	2.2
Western Union.....	123	123	.....	.....	.....	1,123,108	1,123,108	0	.....	0.0	9,278	9,241	.....	37	0.4
West Jersey.....	123	123	.....	.....	.....	623,391	680,856	57,465	.....	9.1	5,070	5,519	.....	449	8.8
West Wisconsin.....	197	197	.....	.....	.....	884,920	869,189	15,731	.....	1.8	4,492	4,416	.....	76	1.7
Totals.....	23,492	23,021	471	.....	2.0	\$208,944,904	\$218,984,535	\$9,939,631	.....	4.6	\$8,904	\$9,512	.....	\$608	6.5
Total increase or decrease.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

panies, and there can be no such character given to any such society in this country unless it shall be similarly formed—shall be an association of railroad companies, getting its authority directly from them, and carrying the weight which comes from the power to do what it wants done, and not simply to ask some one to do it.

Railroad Earnings in 1874.

We publish to-day a table of the earnings for 1874 and 1873, with comparisons in gross and per mile, of all the railroads of this country from which reports have been received at this date, including most of those which make a report for the calendar year. This list includes the lines of 69 companies, with 23,492 miles of road—about one-third of the entire mileage worked during the year. A notable fact illustrating the decline in railroad construction of late is the slight increase shown by the lines in this table over the mileage which they worked in 1873. It is only 471 miles, or two per cent. The gross earnings of these

with all his skill and economy, which may have kept down all the expenses under his control to a very low figure, find his savings largely or even more than counterbalanced by enormous tax bills. Nevertheless, we believe that taxes should properly be included in working expenses, as they are inseparably connected with the conduct of railroad or any other business in which capital is invested, and are really a payment for indispensable services. If there were no Government, maintained by taxes, it would be necessary for every railroad company (that is, if there could be any traffic or any railroad in such a state of society) to maintain a small army for the protection of its property. The money which railroad companies pay for taxes goes for exactly such services as it gets from its own paid watchmen, detectives, special policemen and attorneys. Law expenses are always included in working expenses; and they are usually entirely beyond the control of the management also, and sometimes (as passages in the history of the Erie Company show) form a considerable proportion of the total expenses. Moreover, there are many other expenses, especially those for maintenance of road, which are often greatly swelled by causes entirely beyond the control of the management. When twenty miles or so of an Arkansas or a California railroad were swept away by an unprecedented flood, there must have been (or would have been, if the roads had been rebuilt) a very pretty bill for maintenance, all properly due to the working expenses of the year; and the great destruction at Green River, on the Union Pacific, this Spring, is another case in point, in which, perhaps a quarter of a million has been added to the working expenses of less than ten miles of road, by unprecedented weather. And there have been accidents which, as things go, were beyond the control of the management, and saddled the accounts of the year with bills for some hundreds of thousands. In fact, it is not possible to judge managements by the results of the working for any single year; there are too many accidents to make that just. But when comparisons are made for that purpose, it is well, doubtless, to omit taxes; but we think it better to say "working expenses without taxes" when this is meant, rather than to understand that taxes are not included unless special mention is made of them. We aim in stating working expenses in a lump sum to include all that the road has spent in getting its gross earnings, so that the difference between them will be the true net income of the property, applicable to increasing that property by new construction, to paying its debts for interest or previously incurred, or for division among its stockholders.

The Grain Movement.

The grain movement receives considerable attention this week in our department of "Traffic and Earnings," figures being given for the four months ending with April and for the eight months of the crop year, as well as for the last week reported. These four months of the calendar year include all that part where the railroads have no lake competition, though a very small amount of the Western shipments for the last week of last month went by lake. The late opening of the Erie Canal would ordinarily discourage lake shipments, but as the railroads now carry from Buffalo to New York at canal rates, it should hardly have any effect this year.

The movements at Northwestern ports (we include St. Louis and Peoria with "lake ports") in comparison with 1874 shows badly for the week, the calendar year and the crop year, the percentages of decrease in receipts for each period, in grain of all kinds, being 5, 25 and 21 per cent. respectively. Shipments are not given for the crop year; both for the week and for the four weeks of the calendar year the decrease is more than one-third. The Atlantic ports' receipts have not been so much affected for the calendar year, being but 8½ per cent. less than last year, against 25 per cent. at the lake ports. This indicates that a larger proportion of grain than heretofore goes through from small stations without being unloaded or reported at the great Northwestern grain depots; and as the grain so shipped which is consigned to interior points in the East is not covered by any of these reports, there must be a large grain movement for which we have no figures.

The great decrease is due chiefly, we repeat, to the exceptionally heavy movement of 1874, with which we have to compare. The figures for flour and grain of all kinds for four years are as follows:

Lake ports' receipts—	1874-75.	1873-74.	1872-73.	1871-72.
Aug. 1 to May 1.				
Flour, bbls.....	3,979,406	4,812,488	4,241,947	4,026,713
Grain, bush.....	104,040,387	131,978,466	110,822,770	104,825,572
Jan. 1 to May 1.				
Flour.....	1,325,425	2,143,330	1,818,457	1,408,230
Grain.....	34,292,426	45,889,036	34,359,940	29,024,340
Lake ports' shipments—				
Flour.....	1,467,474	1,943,798	1,827,056	1,070,270
Grain.....	16,613,822	25,025,359	16,507,290	15,595,423
Atlantic ports' receipts—				
Flour.....	2,803,585	3,022,113	2,719,449	3,312,196
Grain.....	29,680,262	32,420,042	19,204,707	21,974,146

Here we see that the Northwestern grain receipts for the eight months of the crop year, though so much less than last year, are nearly the same as three years ago and but 5½ per cent. less than two years ago. And the winter grain movement, about which there has been so much complaint, is on the whole extremely good. The lake ports, which appear worst, received just about as much and shipped more than in 1873, and their receipts were a sixth larger than in 1872. The receipts at seaboard, 8½ per cent. less than last year for the four months, are 55 per cent. greater than in 1873 and a third more than in 1872.

Conventions.

The following conventions of engineering and railroad societies will be held within the next few weeks:

MASTER CAR-BUILDERS' ASSOCIATION.

This Association will hold its annual convention on Wednesday, June 9. The hotel selected for the accommodation of members is the Grand Central, No. 671 Broadway.

As there are several hotels of similar name in New York, strangers in the city should be careful to name the Grand Central, as there are the Grand Hotel and Grand Union besides.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

This Society will hold its Seventh Annual Convention in Pittsburgh on the 8th, 9th and 10th of June.

REASONABLENESS, in the sense of a disposition to reason, is a quality which railroad officials do not always display. Having decided that such and such a policy is advisable, they give orders to that effect, and if people grumble, they simply enforce the rules, and let the grumbling go on. That will do very well in an army, perhaps, but it is a bad policy in dealing with customers. When an unpopular policy has been adopted it will almost surely be deemed unjust if no attempt is made to give the reasons for it after complaints have become common. We think there has been a tendency recently to be more "reasonable" and pay attention to complaints. An instance of this we notice in St. Louis, where the Missouri Pacific, having raised its commutation rates for suburban traffic, and its patrons having protested vigorously, the General Passenger Agent, Mr. E. A. Ford, wrote out a statement in explanation, showing that the business had hitherto been done at a loss, and that the new rates were still as low as or lower than those of Eastern railroads with much greater traffic. Such an example deserves imitation. Some men, at least, are reasonable creatures, and all men like to be treated as if they were. Even if an explanation convinces but a few, the difference between a unanimous feeling and a prevailing feeling of hostility is immense; and even if it convinces nobody, the people unconvinced are at least somewhat pacified by the fact that the company has had enough consideration for them to try to convince them.

NEGLECT was criminally punished in England recently, in the case of a "night inspector" of a railroad, who "forgot" that he had ordered one train forward, and so ordered another right into it, occasioning a terrible collision, by which many lives were lost. He was tried for manslaughter, last month, found guilty, "with a strong recommendation to mercy," and sentenced to eighteen months' imprisonment, with hard labor. A case almost precisely similar in Ohio, where the guilty person was a young woman who acted as telegraph operator, resulted in the poor creature's dismissal from the company's service!

THE PROGRESS IN IRON BRIDGE CONSTRUCTION in this country is well shown by the fact that the great Portage bridge of the Erie Railway, recently burned, is to be renewed by an iron structure for a double track, the cost of which will not be more than that of the original wooden structure built for a single track. Contracts have been let for the new structure.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS has removed its offices from No. 69 William street up town to No. 4 East Twenty-third street, New York, which will be much more accessible to most resident and visiting members, especially for evening meetings.

NEW PUBLICATIONS.

Continuous Revolving Draw Bridges. By Clemens Herschel, C. E. Little, Brown & Co.; Boston, 1875.

The memoir before us of 54 pages is a reprint from the transactions of the American Society of Civil Engineers; to which Society it was presented in competition for the Norman medal. The publishers have done wisely in thus placing before the profession at large the best treatise extant in the English language upon skeleton continuous girders as applied to *revolving bridges*. Not that it is exhaustive by any means, but the general principles governing the subject, complex from its very nature, are well set forth with a practical application in a well-worked example under various conditions of loading. The only discussions we can call to mind, upon the subject, are the ones published in Channut's account of the building of the Kansas City Bridge, and that by Mr. A. P. Boller in the *Railroad Gazette*, March 22, 1873 (page 116).

Mr. Herschel has brought to his task unusual qualifications, in that his familiarity with the French and German languages, superadded to his accomplishments as a mathematician, has been an "open sesame" to a vast amount of otherwise inaccessible literature. This he has culled with great industry, and has given the results with that practical cast that only a practising engineer would be likely to do. In a short introductory, after paying a tribute to the accomplishment by American engineers in the building of single fixed span bridges "to a degree of perfection and size hitherto unknown," Mr. Herschel says: "It is a painful fact that in the calculation of strains in continuous drawbridges, unsupported opinion and good enough approximations have often had a controlling voice." "And it is, perhaps, only a natural consequence of this that there are many unpleasant rumors as to the unsatisfactory performances, wear and life of many of the great drawbridges of the country, both of the old and new styles;" referring to galloping-frame bridges as well as self-sustaining trusses.

Such being the case, Mr. Herschel submits the subject as one of "practical and ample pecuniary interest to the profession and to their employers."

In a work like the one before us, it is impossible to epitomize its contents in a manner that will do justice either to the author or to the reader, but in general we may refer to the mode of treatment as one in which the reactions of the points of support form the key note of the system. The reaction once found, the strains in any structure can be readily computed by the method of sections. The author pays a glowing tribute to the work of August Ritter (Hanover, 1873, which, we understand, will be soon translated), and enthusiastically avows that his labors will not be in vain, "if achieving nothing else, he will awaken in the minds of some of his readers a realizing sense of the beauty of the principles used by Ritter." This method is wholly embraced in the principle that the sum of all tenden-

cies to rotate about any point in the plane of the girder, or in other words all moments, must equal 0.

The advantages of this method are, that it throws aside all effort of the memory, involving as it does *principles*, not equations. Mr. Herschel thinks it exceeds in value even Napier's rules in spherical trigonometry.

Under the heading of "Practical Considerations," Mr. Herschel makes a statement to the effect that in continuous draw bridges the defects of separate counter bracing becomes apparent, that is to say, the Warren and double triangular systems are more perfect than that of the Whipple, or vertical post system, which involves of course independent counters. If we understand him correctly, this statement of the author is made on the ground "that a member that will resist both tension and compression can always be made to weigh less than one to resist tension or compression running in one direction, added to its counter of like quality running opposite to it, especially when we have regard in the two cases to the useless dead weight above referred to." On this assertion he could probably find more than one engineer to take issue with him, and many are of the opinion that in those pin connection structures, where the members of the web system act by either tension or compression, there is an undesirable back and forth action between the eyes and pins, due to the play necessarily allowed in practice at the joints. A perfectly tight-fitting joint is impossible, and a play of 1-32 of an inch is a customary allowance. Of course no one would dispute the economy of material in a triangular web, as compared with that having vertical thrust members, but that this difference can be spoken of as a *defect* is not a fair criticism in comparing two systems each theoretically perfect in itself.

However, be these differences of opinion as they may, they do not affect the value of the work, covering *principles*, eternal and unchangeable. The admirable treatment of the subject, the clear concise English in which it is written, and the industry involved in its preparation, cannot but enhance the well earned reputation of its gifted author.

There are those who may be disappointed in this memoir, if they peruse it with the idea that it is a short-cut path to a most intricate subject, and that no previous theoretic training is necessary for its understanding. To all such we say, do not purchase it, as you will be no wiser after its perusal than you were before. But to the engineer who has given attention to the principles involved in scientific bridge building, we would say that there is no substitute for this memoir known to us in the English language, and until Mr. Shreve, or some other clear-headed writer, treats of the same subject, it stands alone as a necessary classic.

Narrow-Gauge Railways in America: Embracing a sketch of the rise, progress and success of the new system, and valuable statistics as to grades, curves, weight of rail, locomotives, cars, etc. Also a directory of narrow-gauge railways in North America. By Howard Fleming.

This is a pamphlet of 80 pages which has recently been published by the author, and is for sale by him (at 25 cents per copy) at No. 216 South Fourth street, Philadelphia. Seventeen pages are taken up in a summary of the statements made in favor of the narrow gauge, including the absurdities of them.

A list of narrow-gauge railroads in America follows (including a considerable amount of road that is not built, but much more correct than most such lists), and a list of projected roads, which latter doubtless might be lengthened. It is rendered more valuable by a statement of the name and address of some officer of each of the projected lines.

More valuable are brief descriptions of some narrow-gauge rolling stock actually in use, with the principal dimensions, and engravings of three locomotives built by the Baldwin Works, the cut of the Jackson & Sharpe car built for the Denver & Rio Grande road which we published a few years ago, one of a cheap car for mixed traffic built at York, Pa., for the Eureka & Palisade road, and one of what is called a third-class passenger car built for the Parker & Karns City road. There are also engravings of a flat car, a box car, a coal dump and a stock car, the latter of 3 ft. 6 in. gauge.

One-half of the pamphlet is devoted to the directory of narrow-gauge railroads, giving such statistics as are usually presented in the railroad manuals, though not at so great length.

The pamphlet, though not by any means complete, is yet of value, as it gives information concerning American narrow-gauge rolling stock and American narrow-gauge companies which cannot be found collected elsewhere.

Wanted, Work.

The following is a specimen of a kind of letter of which we receive several every week. It describes, as the reader will perceive, a very hard case and one for which we would be very glad to afford some alleviation if it were in our power. But situated as we are it is practically impossible, without neglecting and ultimately abandoning our business of publishing a paper, to undertake to provide for all who would apply for our intervention in such cases. We therefore trust that correspondents will avoid the error of supposing that our business is that of an "employment agency" or "labor bureau."

TO THE EDITOR OF THE RAILROAD GAZETTE:

The object of this letter is a rather peculiar one, considering the circumstances. But, to come to the point, I will make it as short as possible by proceeding at once to business. From the time I was 10 years old I have evinced a very strong desire to be a railroad man; in fact, to live a life on the rail has been the greatest desire of my life, and has been increasing as long as I can remember until my present age, which is 23 years. During the interval of my life between 18 and the present time I have tried every available means and done everything in my power to obtain the position of stoker or fireman on a locomotive, but so far without success or encouragement. Four years ago I stated my object to the Superintendent of the — Locomo-

five Works, who kindly secured for me a position in that establishment to learn the machinist trade, where I served under the foremanship of Mr. ——. I steadily adhered to my trade and was just getting thoroughly interested when the late financial difficulties arose. At this time orders for work immediately slackened down, and I, being under instruction, could not earn enough money to pay my board in the city. I went into the country and worked on a farm for my board. The following spring business did not start up as I anticipated, and I could not get in again.

I am thoroughly familiar in every respect with the locomotive. I have studied drafting and chemistry, and I am fully qualified for the position that I am seeking. And now I am going to take the presumption to ask you to help me in my endeavors to get the position I am after. I ascertained from your valuable paper that you were fully acquainted and had great influence with all the leading railroads in the country. Now I ask you to please take interest enough in my case to secure for me the position of fireman on some railroad. I do not care what road it is. The wages are no object at all. I will place \$40 (all the money I have) in your hands as security to show that I am in earnest. I can get references from — or from the farmers for whom I have worked.

I hope you will not throw this in the waste basket. If you will kindly condescend to answer this letter, and if you wish me to I will come to New York and call at your office.

Yours respectfully,

H. J. H.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

Hamilton & Northwestern.—At the annual meeting in Hamilton, Ont., April 4, the following directors were chosen: J. Stuart, Wm. Hendrie, W. Leggett, Thomas Saunders, J. Field and W. Dayfoot. Two vacancies remained to be filled by the board. The board re-elected John Stuart, President; J. Field, Vice-President; Maitland Young, Secretary.

Southern Maryland.—At the annual meeting in Washington, May 6, the following directors were chosen: Samuel S. Smoot, John Van Riewick, E. N. Darling, Frank Hume, Horatio Browning, James L. Barbour, Andrew Saks, Charles B. Church, T. A. Cook, Washington; Benj. G. Harris, John M. Brome, St. Mary's County, Md.; H. B. Beymer, Baltimore.

Columbia Conduit Company.—At the annual meeting in Pittsburgh, May 3, the following officers were chosen: President, D. Hostetter; Vice-President, John H. McElroy; directors, A. Hartup, C. L. Stoner and C. S. Frisbee; Secretary, W. H. McClelland; Treasurer, Samuel McClurkin.

Detroit, Lansing & Lake Michigan.—Mr. John B. Mulliken has been appointed General Superintendent of the road of this company, in the place of A. H. Reese, who has resigned and retired from its service. Mr. Mulliken entered upon the duties of his office May 1. Mr. John J. Grafton has been appointed Assistant Superintendent in place of O. N. Hinkle, resigned.

Marquette, Houghton & Ontonagon.—Mr. James S. Mott has been appointed Purchasing Agent and Supply Clerk, and all requisitions for supplies will hereafter be addressed to him at Marquette, Mich.

Valley, of Ohio.—The new board of directors has elected the following officers: Vice-President, James Farmer; Secretary, L. D. Clark; Treasurer, S. T. Everett; Chief Engineer, R. H. Dudley. The election of the President was postponed until the return of Mr. D. L. King from Europe.

Pittsburgh, Wheeling & Kentucky.—At the annual meeting in Wheeling, W. Va., recently, the stockholders elected Hon. C. D. Hubbard President and Michael Reilly, Thomas Hughes, John McLure, Abram Wilson and H. J. Lazier, directors.

Seaboard & Roanoke.—At the adjourned annual meeting in Portsmouth, Va., May 4, Col. John M. Robinson was unanimously re-elected President, with the old board of directors, as follows: D. A. Barnes, B. Dickson, Nalbro Frazier, Thomas Kelso, Monroe Robinson, W. L. Savage.

Mississippi.—At the annual meeting in St. Albans, Vt., April 30, the following directors were chosen: A. O. Brainerd, S. P. Carpenter, N. W. Martin, Daniel Moran, Homer E. Royce, E. A. Smith, Charles B. Swift, A. W. Woodworth. The board elected officers as follows: President, S. P. Carpenter, Richmond, Vt.; Vice-President, E. A. Smith, St. Albans, Vt.; Secretary, George G. Smith, St. Albans; Treasurer, J. W. Newton, St. Albans.

Susquehanna.—At the annual meeting in Newton, N. J., recently, the following directors were chosen: Joseph Coult, Benjamin Courtright, John Linn, Martin Ryerson, Newton, N. J.; John I. Blair, Blairstown, N. J.; D. C. Blair, Selden T. Scranton, Belvidere, N. J.; Wm. E. Dodge, Edwin F. Hatfield, Jr., Percy B. Pyne, Moses Taylor, New York.

Providence & Stonington Steamship Company.—Capt. D. S. Babcock is President of this new company, formed by the consolidation of the Stonington and the New York & Providence Steamship Companies. Mr. L. W. Filkins is General Passenger Agent.

Greenville & Columbia.—At the annual meeting in Columbia, S. C., April 29, there were 54,311 shares voted and W. J. Magrath was chosen President, with the following directors: Robert Adger, L. D. Childs, Joseph Crews, H. T. Farmer, F. F. Gray, Edward Hope, Timothy Hurley, R. L. McCaughin, Alexander Macbeth, J. C. Roath, A. Simonds, Theodore D. Wagner.

Kansas Pacific.—At the annual meeting in Lawrence, Kan., May 7, the following directors were chosen: Robert E. Carr, Adolphus Meier, Carlos S. Greeley, John D. Perry, B. W. Lewis, Jr., Stephen M. Edgell, St. Louis; Thomas A. Scott, Philadelphia; Sidney Dillon, Jay Gould, James D. Smith, New York; Oliver Ames, Boston. The last four represent the Union Pacific interest under the recent agreement, and are new directors, replacing T. G. Meier, Robert Barth, L. H. Meyer and Matthew Baird. The board re-elected Robert E. Carr President; C. S. Greeley, Treasurer; D. M. Edgerton, Secretary.

Lake Shore & Michigan Southern.—The new board of directors has re-elected the old officers, as follows: President, Cornelius Vanderbilt; First Vice-President, Wm. H. Vanderbilt; Second Vice-President, Augustus Schell; Managing Director, Amasa Stone, Jr., Cleveland, O.; Treasurer, Edwin D. Worcester, New York; Secretary and Assistant Treasurer, George B. Ely, Cleveland; Auditor, C. P. Leland, Cleveland; General Superintendent, Charles Paine, Cleveland; Purchasing Agent, A. C. Armstrong, Cleveland.

Chicago, Burlington & Quincy.—Mr. George Simpson has been appointed Train Dispatcher at Aurora, Ill., in place of W. H. Mixer, Chief Train Dispatcher, who has been transferred to the general office in Chicago.

New York, West Shore & Chicago.—Mr. Livingston Lansing, of Buffalo, has been appointed Receiver of the property of this bankrupt corporation.

Danvers & Hudson Canal.—At the annual meeting in New

York, May 11, the following managers were chosen: A. A. Low, Robert Lenox Kennedy, James M. Halstead, Legrand B. Cannon, James R. Taylor, John Jacob Astor, W. J. Hopkins, J. Pierpont Morgan, George Cabot Ward, Robert S. Hone, James Roosevelt, New York; Thomas Cornell, Kingston, N. Y.; Thomas Dickson, Scranton, Pa. Messrs. Hone and Roosevelt are new directors, replacing Charles N. Talbot and R. M. Olyphant.

Central of New Jersey.—At the annual meeting in Jersey City, May 7, the old board was re-elected, as follows: John Taylor Johnston, John C. Green, Adam Horrie, James Boorman Johnston, New York; Frederick F. Frelinghuysen, Newark, N. J.; John Kean, Benjamin Williamson, Elizabeth, N. J.; John Leisnering, Mauch Chunk, Pa.

Reading & Lehigh.—The annual meeting was held in Reading, Pa., May 3, and the following were elected: President, George F. Baer, Directors, Henry Bushong, W. B. Griesemer, Henry S. Eckert, J. V. Craig, J. Dutton Steele, C. G. Derr.

Ohio & Mississippi.—Mr. R. N. Robinson, late General Train Master, has been appointed General Baggage Agent. The office of General Train Master is abolished.

Baltimore, Hampden & Towson.—At the adjourned annual meeting in Baltimore May 8, the following directors were chosen: A. W. Bradford, Jr., W. C. Wilson, J. R. Clarke, George Drakely, Dr. N. R. Monroe, A. Edmundson, Dr. J. H. Prentiss.

St. Louis & St. Paul.—The annual meeting recently, the following directors were chosen: E. F. Drake, John T. Merriam, H. Wilder, Horace Thompson, St. Paul, Minn.; Adrian Iselin, George J. Sewell, W. S. Brown, New York; A. P. Price, G. W. Simmons, Boston.

PERSONAL.

—Mr. Stillman Witt, of Cleveland, whose death by a fall on ship-board as he was on his way to Europe we have announced heretofore, was born in Worcester, Mass., in 1808. His parents were poor, and when this son was 13 years they removed to Troy, N. Y., where soon after he did his first work as a ferryman on the Hudson for wages of ten dollars a month. Then he met an officer of the Corps of Engineers on whom he made a favorable impression for his intelligence and interest in construction, so much so that the officer, Captain White took charge of him and educated him as an engineer. Soon he was able to take charge of a large manufactory at Cohoes; next he was engaged on the construction of the bridge over the Susquehanna at the mouth of the Juniata; then for a year and a half on the Louisville & Portland Canal, then local agent at Albany of the Hudson River Steamboat Association, from which position he was called to become Manager of the Western Railroad, of Massachusetts (now the western part of the Boston & Albany.) This position he occupied for eight years, and in it gained the experience which afterward gave him his reputation as a railroad man. He went to Ohio to enter a firm which took the contract for constructing the railroad from Cleveland to Columbus, the firm being composed of Frederick Harbach, an eminent engineer, Amasa Stone, Jr., an experienced bridge builder, and Mr. Witt, and going under the name of "Harbach, Stone & Witt." This firm also took the contract for constructing the Cleveland Painesville & Ashtabula Railroad, but before it was completed Mr. Harbach died. Mr. Stone and Mr. Witt continued in their partnership, and next built the Chicago & Milwaukee Railroad, which they worked for some time after it was completed. In all cases a large part of their pay consisted of securities of the roads which they built. Mr. Witt afterwards secured the consolidation of the Bellefontaine & Indiana, then a very poor property, with the Cleveland & Columbus road, which proved very fortunate. During the war John Brough was President of this company, when he was nominated for Governor of Ohio. Feeling too poor to give up his salary as President of the company, he would have refused the nomination, but Mr. Witt took to himself the duties of the presidency, and left the salary to Governor Brough, who became one of the most noted of the "war governors." He had been for a great many years a director of the Lake Shore & Michigan Southern Company, or of one of those from which it was composed, and of the Cleveland, Columbus, Cincinnati & Indianapolis, and was at the time of his death President of the Valley Railroad Company of Cleveland. Speaking of his character, the Cleveland Leader says: "His reputation for integrity and able management had become so fully recognized that to secure his services in the prosecution of an enterprise was deemed equivalent to the assurance of its success. Meanwhile, he had been active in various charitable and benevolent projects."

And elsewhere, speaking of the news of his death:

"It falls upon this community as a public calamity. He was not only a man whom a tireless energy and self-earned wealth made powerful, but he was one whom charity, benevolence and human sympathy made generous and genial to those about him. There is a moral in the story of his life that the young men of this day may profitably study."

Mr. Witt had suffered severely from rheumatic gout during the past two or three years, and it was partly in hope of relief that he sailed for Europe.

—The friends of Mr. J. B. Sutherland, who recently resigned his position as Superintendent of the Locomotive and Car Department of the Michigan Central road, after many years' service, have presented him with a library of 200 volumes, accompanied by resolutions expressive of their respect and esteem, the latter being very handsomely engrossed and framed.

—Mr. Charles H. Pepper, Chief of the Telegraph Department of the Texas & Pacific road, was married at Marshall, Tex., April 29, to Miss Elizabeth Halleck Ross, daughter of Col. J. W. Ross.

—Mr. J. B. Alexander has resigned his position as Chief Engineer of the Indianapolis, Bloomington & Western Railroad, to take effect May 15.

TRAFFIC AND EARNINGS.

Railroad Traffic.

The following returns are for the month of March:

Utah Central:—				
	1875.	1874.	Inc. or Dec.	P
Tons of freight moved...	8,640	10,221	Dec..1,581	18
Utah Southern:—				
Tons of freight moved...	5,257	6,051	Dec....794	15

Utah Central returns include 3,635 tons of coal and coke; Utah Southern 2,154 tons of ore and bullion.

The number of freight cars passing through Indianapolis on the various roads for the week ending May 1 was 11,821, an increase of 345 over the previous week.

Shipments of through freight eastward over the Central Pacific Railroad during March were:

	1875.	1874.	Inc. or Dec.	P. c.
San Francisco, tons.....	3,072	3,078	Dec. 6	0%
Interior points.....	390	354	Dec. 36	10%
Totals.....	3,462	3,432	Dec. 30	3%

The Keokuk & Des Moines Railroad reports as follows for the year ending March 31, 1875:

	Passengers.	Freight.	Total.
Train mileage.....	191,860	238,723	430,583
Passengers and tons freight carried.....	146,659	222,346	
Carried one mile.....	5,500,000	17,048,127	

The principal item of freight was grain, of which 83,940 tons were carried.

Flour and Grain Movement.

The returns for the week ending May 1, for the first four months of the calendar year, and the Western receipts for the eight months of the crop year from Sept. 1, 1874, to May 1, 1875, are as follows, flour in barrels and grain in bushels:

WEEK ENDING MAY 1.		1875.	1874.	Inc. or Dec.	P. c.
Flour:					
Lake ports' receipts.....	107,814	130,615	Dec.	22,801	17%
" " shipments.....	100,966	128,471	"	27,505	21%
Atlantic ports' receipts.....	304,912	301,532	Inc.	3,380	1%
Wheat:					
Lake ports' receipts.....	1,033,636	1,279,845	Dec.	246,209	19%
" " shipments.....	943,438	1,313,346	"	1,129,908	82%
Atlantic ports' receipts.....	413,998	875,940	"	461,942	82%
Corn:					
Lake ports' receipts.....	1,788,082	1,333,183	Inc.	454,899	34%
" " shipments.....	1,124,342	918,158	"	206,184	22%
Atlantic ports' receipts.....	1,256,270	1,000,920	"	255,350	25%
Grain of all kinds:					
Lake ports' receipts.....	3,392,287	3,292,166	"	100,121	5%
" " shipments.....	1,677,116	2,537,999	Dec.	860,873	34%
Atlantic ports' receipts.....	1,965,833	2,285,946	"	320,113	16%

JANUARY 1 TO MAY 1.		1875.	1874.	Inc. or Dec.	P. c.
Flour:					
Lake ports' receipts.....	1,356,436	2,143,330	Dec.	182,096	8%
" " shipments.....	1,467,474	1,943,706	Dec.	476,232	24%
Atlantic ports' receipts.....	2,803,585	3,622,113	Dec.	818,528	22%
Wheat:					
Lake ports' receipts.....	12,343,068	22,008,848	Dec.	9,665,780	43%
Lake ports' shipments.....	5,091,138	13,952,940	Dec.	8,861,802	63%
Atlantic ports' receipts.....	6,875,748	12,918,705	Dec.	6,042,957	49%
Corn:					
Lake ports' receipts.....	14,682,764	13,933,095	Inc.	749,669	5%
" " shipments.....	7,605,070	6,359,439	Inc.	1,245,631	11%
Atlantic ports' receipts.....	17,875,077	14,498,128	Inc.	3,376,949	23%
Grain of all kinds:					
Lake ports' receipts.....	34,252,426	45,809,095	Dec.	11,556,610	25%
Lake ports' shipments.....	16,613,322	25,025,359	Dec.	8,411,937	33%
Atlantic ports' receipts.....	29,680,252	32,420,042	Dec.	2,739,790	8%

AUGUST 1, 1874, TO MAY 1, 1875.		1874-75.	1873-74.	Inc. or Dec.	P. c.
Flour:					
Lake ports' receipts.....	3,979,408	4,812,488	Dec.	833,080	21%
" " shipments.....	46,873,794	63,343,823	Dec.	16,470,029	26%
Atlantic ports' receipts.....	33,342,470	40,570,730	Dec.	7,228,260	18%
Grain of all kinds.....	104,040,387	131,978,466	Dec.	27,938,079	21%

Lake Traffic.

The first vessels through the Straits of Mackinaw, bound down, this season, was the steamship Superior, with the barge Sandusky in tow, carrying grain. They passed through May 7. Lake rates to Buffalo are, from Chicago about 3½ cents per bushel, and from Milwaukee about 4¼ for wheat, by sail.

Provision Exports.

The exports of hog products from the United States for the six months ending with April in tons were:

	1874-75.	1873-74.	Decrease.	P. c.
Pork.....	13,109	16,090	4,981	27%
Cut meats.....	85,260	120,110	34,850	29%
Lard.....	55,071	64,689	9,618	14%
Totals.....	154,040	200,889	46,849	24%

Petroleum Exports.

From Jan. 1 to May 1 the exports of the following ports (almost the only ones which ship by sea) were as follows, in gallons:

	1875.	1874.	Inc. or Dec.	P
New York.....	36,947,040	39,309,831	Dec., 2,362,791	1
Boston.....	831,658	934,382	Dec., 102,624	1
Philadelphia.....	9,082,686	18,614,883	Dec., 9,532,197	52
Baltimore.....	7,430,146	1,119,493	Inc., 6,310,653	82
Total gallons.....	54,291,540	59,978,559	Dec., 5,687,019	

The increase in Baltimore is about two-thirds of the decrease at Philadelphia and brings the former city next to Philadelphia as an exporter of petroleum.

Cotton Movement.

Galveston cotton receipts and exports for the eight months from September 1 to April 30 were:

	1874-75.	1873-74.	Inc. or Dec.	P. c.
Receipts, bales.....	343,704	351,523	Dec.	7,819
Exports, bales.....	307,029	313,261	Dec.	6,232

Coal Movement.

The tonnage of anthracite coal reported by the leading lines for the four months ending May 1 was as follows:

	1875.	1874.	Inc. or Dec.	P. c.	
Del., Lacka. & Western.....	916,968	785,560	Inc.	131,408	16
Lehigh Div., Central of N. J.....	170,729	601,694	Dec.	430,965	71
Del. & Hudson Canal Co.....	905,019	719,908	Inc.	185,111	16
Pa. Coal Co., over Erie Ry.....	928,421	359,549	Inc.	568,872	24
Philadelphia & Reading.....	586,052	1,655,949	Dec.	1,069,897	63
Schuylkill Canal.....	513	149,076	Dec.	148,563	99
Lehigh Valley.....	464,843	1,353,576	Dec.	888,733	65
Shamokin Div., North. Cent.....	165,281	109,796	Inc.	55,485	50
Summit Branch.....	115,839	90,292	Inc.	25,547	28
Totals.....	3,603,665	5,884,840	Dec.	2,220,975	37

The production in the Schuylkill and most of the Lehigh region is now almost nothing. In the Schuylkill region matters are very threatening, and attempts to wreck trains and burn bridges are of frequent occurrence. Threats and in some cases actual violence have been used to deter men who might wish to do so from doing work.

Semi-bituminous, four months ending May 1:

	1875.	1874.	Inc. or Dec.	P. c.
Clearfield coal over Tyrone Div.,				
Pa. R. R.....	250,346	199,946	Inc. 50,400	25%
Huntingdon & Broad Top.....	63,489	85,119	Dec. 21,630	25%
East Broad Top.....	11,040		Inc. 11,040	
Totals.....	324,845	285,065	Inc. 39,780	14%

Cumberland, four months ending May 1:

	1875.	1874.	Inc. or Dec.
Baltimore & Ohio	409,963	411,061	Dec. 7,108
Chesapeake & Ohio Canal.....	46,686	66,640	Dec. 19,954
Bedford Div., Penna. R. R.....	54,649	33,941	Inc. 20,708
Totals	509,298	510,642	Dec. 11,354

Other bituminous coals:

Allegheny region.....	61,668		
Pittsburgh region.....	269,242		
Chesapeake & Ohio R. R.....	49,997		
Total.....	491,849		
Coke Western Penna.....	204,427		

The Lake Marine.

June 30, 1874, the number and tonnage of American vessels on the Great Lakes were as follows:

	No.	Tonnage.
Sailing vessels.....	1,096	236,802
Steam vessels.....	876	196,121
Barges.....	216	46,323
Canal boats.....	2,812	261,136
Total.....	5,600	840,382

A year before, though there were but 24 less vessels, the tonnage was smaller by more than 6 per cent.

Railroad Earnings.

Earnings have been reported by the following companies:

Year 1874:

	1874.	1873.		
Chic., Mil. & St. Paul.....	\$8,983,017	\$9,046,124	Dec.	\$93,107 1
Expenses.....	5,871,116	6,594,560	Dec.	723,444 11
Net earnings.....	\$3,081,901	\$2,451,564	Inc.	\$630,337 25%
Earnings per mile.....	6,142	6,536	Dec.	394 6
Per cent. of expenses.....	68.32	72.90	Dec.	4.58 6%
Western Union.....	\$1,123,108	\$1,137,634	Dec.	\$14,526 1%
Expenses.....	768,164	878,241	Dec.	110,977 12%
Net earnings.....	\$354,944	\$259,393	Inc.	\$95,551 36%
Earnings per mile.....	5,273	5,341	Dec.	68 1%
Per cent. of expenses.....	68.40	77.22	Dec.	8.92 11%

Six months ending December 31:

	1874.	1873.		
Grand Trunk.....	\$1,127,031	\$1,061,197	Inc.	\$65,834 6%
Expenses, inc. renewals.....	890,459	863,106	Inc.	27,353 3%
Net earnings.....	\$236,572	\$198,091	Inc.	\$38,481 19%
Loss on Am. currency.....	19,785	24,693	Dec.	4,908 19%
Balance.....	\$216,787	\$173,398	Inc.	\$43,389 25%
Earnings per mile.....	819	771	Inc.	48 6%
Per cent. of expenses.....	79.01	81.33	Dec.	2.32 2%

Six months ending January 31:

	1874-75.	1873-74.		
Great Western.....	\$211,738	\$205,916	Dec.	\$114,178 18%
Expenses and taxes.....	359,877	430,080	Dec.	40,203 9%
Net earnings.....	\$121,861	\$195,836	Dec.	\$73,975 37%
Loss on Am. currency.....	26,340	27,216	Dec.	876 3%
Balance.....	\$95,521	\$168,620	Dec.	\$73,099 43%
Earnings per mile.....	1,001	1,307	Dec.	306 23%
Per cent. of expenses.....	76.19	68.71	Inc.	7.48 10%

Year ending February 28:

	1874-75.	1873-74.		
Seaboard & Roanoke.....	\$463,426	\$429,063	Dec.	\$87,196 13%
Expenses.....	406,365	429,063	Dec.	22,698 5%
Net earnings.....	\$157,061	\$221,559	Dec.	\$64,498 29%
Earnings per mile.....	7,043	8,133	Dec.	1,090 13%
Per cent. of expenses.....	72.12	65.95	Inc.	6.17 9%

Month of March:

	1875.	1874.		
Mobile & Ohio.....	\$130,251	\$174,968	Dec.	\$44,717 25%
Central Pacific.....	\$1,365,000	\$1,110,623	Inc.	\$244,377 22%
Denver & Rio Grande.....	32,356	29,613	Inc.	2,743 9%
Illinois Central.....	586,716	586,962	Dec.	246
Ind., Cin. & Lafayette.....	142,362	161,756	Dec.	9,393 6%
St. Louis, Alt. & T. H.....	86,948	100,283	Dec.	13,335 13%
St. Louis, Alt. & T. H., branches.....	59,320	63,757	Dec.	4,437 7%
St. Louis, Iron Mt. & So.....	258,570	230,434	Inc.	28,136 12%
Union Pacific.....	1,092,983	742,847	Inc.	\$350,136 43%
Week ending April 10:—	\$118,952	\$22,998	Dec.	\$4,046 17%
Week ending April 17:—	\$29,900	\$43,400	Dec.	\$13,500 8%
First week in May:—	\$282,070	\$173,392	Inc.	\$78,678 46%

Central Pacific earnings are thus compared with those for 1873:

	1875.	1873.		
Month of April.....	\$1,365,000	\$1,129,469	Inc.	\$235,531 20%
Four months end. April 30.....	\$4,399,000	\$3,650,530	Inc.	\$748,470 18%

But few companies are now reporting monthly earnings, and their reports come in slowly.

OLD AND NEW ROADS.**Columbia Conduit Company.**

The sale to the Empire Transportation Company has fallen through, and the company has been reorganized. It is said that the pipes have been laid across the river, and that for the present the company intend to wagon the oil over the tracks of the West Penn Railroad, and after re-tanking force it to the cars. By this means there will be direct communication between the Butler County oil regions and the seaboard at Baltimore. The expense of the transfer at the West Penn Railroad track, it is stated, will not be large.

Welland Canal Improvement.

The Department of Public Works of the Dominion of Canada will receive proposals until June 1, for the construction of a tunnel, a number of locks, regulating weirs, bridge abutments and piers, excavation, dredging, etc., connected with several miles of the enlargement, also the extension and deepening of Port Dalhousie and Port Colborne Harbors. The works will be let in sections, some of which are situated on the new line between Port Dalhousie and Thorold, and others, about one mile in length each, consist principally of deepening and widening the present canal at places between Thorold and Port Colborne.

Maps of the several localities, together with plans and specifications of the works, can be seen at the office, in Ottawa, Can., where printed forms of tender can be obtained. A like class of information relative to the works north of Allentown will be furnished at the Resident Engineer's office, Thorold, Ont.; and for works south of Port Robinson, plans, etc., may be seen at the Resident Engineer's office, Welland, Ont.

Bids must be sent to the office of the Department in Ottawa, Can.; they must be on the printed forms, and be accompanied by a check for from \$1,000 to \$3,000, according to the amount of the contract.

New York, West Shore & Chicago.

On application of a bondholder, the United States Circuit Court in New York has granted the usual injunction against the company, and an order appointing Livingston Lansing, of Buffalo, Receiver. There are said to be \$3,000,000 of bonds outstanding, besides \$150,000 floating debt, and about all there is to show for them is some right of way along the Hudson and in the Mohawk valley, some real estate in Buffalo, and a little work done on a tunnel at West Point. No track was ever laid.

Detroit & Milwaukee.

In the Wayne County Circuit Court recently the Great Western Railway Company was made a party to the foreclosure suits. An order was also issued directing the receiver to reimburse the State for the cost of laying the side track from its main line at Pontiac to the locality of the new State Insane Asylum, now in the process of construction there.

The order appointing Mr. Trowbridge receiver was modified so as to enable him to pay connecting railroads for passenger tickets (for through travel), freight rates, etc., \$26,475.56; the wages of the employees of the road for the month of March, amounting to \$36,171.60, wages to the same for the first half of April, aggregating \$22,017.11; interest upon \$700,000 of mortgages, amounting to about \$25,000; \$81,000 for wood and ties; \$38,445.70 for stores and supplies; and also so as to enable him to lease the dining-room at the depot to W. J. Fowler.

St. Paul and Pacific.

In the long pending suit in the New York Supreme Court to recover certain rails which are claimed by the bondholders and which, after being pledged to various parties, were finally turned over to the United States as security for money of the Navy Department held by Jay Cooke, McCullough & Co., the Court has decided that Mr. Morehead had no right to pledge any of

the iron; that the Cooke firms are chargeable with all of Morehead's knowledge; that therefore they obtained no right to the iron, but that those who are not chargeable with Morehead's want of authority and who actually advanced money on the faith of the iron, stand in the position of innocent purchasers, and have a right to foreclose the lien by selling the iron to reimburse themselves; that the New York Guarantee & Indemnity Company stand in that position, and the injunction against removing the rails must be vacated as to them; that the Secretary of the Treasury stands in the same position as to iron pledged to him for an advance, and the injunction would be vacated as to him, if it appeared that the advance had not been repaid, but as to the portion pledged to him for money then due from Cooke, McCullough & Co., it was not for money advanced, and he stands in no better light than that firm.

Dividends.

Dividends have been declared by the following companies: Cleveland & Pittsburgh, 1½ per cent., quarterly on the guaranteed stock, payable June 1.

Peterborough (leased by Boston & Lowell), 3 per cent., semi-annual.

Illinois Central.

The Land Department reports for April sales of 2,081.63 acres for \$15,237.28. Cash collections amounted to \$25,167.67.

The Traffic Department reports the April earnings as follows:

	1875.	1874.		
In Illinois, 707 miles.....	\$449,637.51	\$469,737.86	Dec.	\$20,100.35 4%
In Iowa, 402 miles.....	137,078.10	117,224.00	Inc.	\$19,854.10 17%
Total, 1,109 miles.....	\$586,715.61	\$586,961.86	Dec.	\$246.25

Pittsburgh, Cincinnati & St. Louis.
At a special meeting held in Steubenville, O., May 4, the stockholders voted to authorize the issue of \$10,000,000 new income bonds to be used in retiring the outstanding issue of \$5,000,000 second-mortgage bonds with accrued interest and in funding other liabilities. There was a pretty sharp discussion at the meeting, and some of the private stockholders took occasion to protest against the policy of the company and the burden put upon it in the way of leases, but the new issue was approved by a vote of 135,604 to 8,017. The investigating committee appointed some time since was notified to hurry up with its report.

Meetings.

The following companies will hold their annual meetings at the times and places given:

Atlantic & Pacific, at the office in New York, May 20, at 11 a. m.
Missouri, Kansas & Texas, in Parsons, Kan., May 19.
St. Paul, Stillwater & Taylor's Falls, at the office, in St. Paul, Minn., May 26, at 10 a. m.
Pacific Mail Steamship Company, at the office, in New York, May 26, at 12 noon.

Alabama & Chattanooga.

The bid of \$1,200,000 made by the trustees at the recent sale is payable in first-mortgage bonds at par and is subject to the Receiver's certificates and the legal costs and charges. The sale will be confirmed or rejected by the Court at the next term, June 7.

The Mobile Register says: "It is proper to say that R. H. Smith, Esq., of counsel for some of the foreign bond-holders, protested against the sale on Monday. More litigation is threatened, and the property may be wholly wrecked before the end. If this sale is permitted to stand, the bond-holders will have to pay off or compromise prior liens to the extent of about a million dollars in excess of their bid. How the State of Alabama will come out of the imbroglio is an interesting question which we will not take upon ourselves at the present moment to solve."

Wilmington & Reading.

The United States Circuit Court has granted the petition for receivers and has appointed the trustees under the second mortgage to that position.

Chicago, Milwaukee & St. Paul.

Suits have been begun to recover from the company \$627,000 claimed to be due the United States for taxes accruing between 1862 and 1872.

The Grant Locomotive Works.

The committee of creditors has submitted a report in which they make the following statement of the liabilities:

Mortgages and interest to Feb. 1.....	\$474,293.25
Merchandise and accounts.....	377,248.73
Total.....	\$851,541.98

There are some contingent claims which may bring the amount up to \$900,000. The real estate, buildings, tools and other assets, including \$90,000 due on the Russian engines, are \$712,651.83, and in the event of a forced sale the assets would not produce over \$340,000.

The loss on the Russian contract, including \$5,000 deposit, were, as far as known, \$288,890.

The plan proposed is substantially that the bondholders shall consent to the satisfaction of all mortgages; that the stock (\$300,000) shall be distributed among the creditors *pro rata*, all net profits to be divided on the stock. The amount so divided, in excess of 6 per cent. interest on the amount of the debts, shall be credited in liquidation. When the full amount is thus paid the stock is to be surrendered to Mr. D. B. Grant by the creditors. The latter are to have a controlling voice in the direction and Mr. D. B. Grant is to be employed as manager of the works at an annual salary of \$10,000.

The large creditors have generally agreed to sign, but it is said that some of the holders of small claims are in doubt. It certainly appears to be the best arrangement possible.

Why Dividends Fall Off.

At the banquet to Mr. Price, on his leaving the Great Western Railway of Canada, he said in his speech: Relative to the failure of dividends at present, he had one fact to mention, which would place the true cause in a striking light. The Great Western was now carrying about 20,000 tons of through freight per week, at \$1.86 per ton, the rate previous to March, 1874, having been \$2.86 per ton. The difference of \$1 per ton on the year's business amounted to over a million of dollars (\$1,040,000), and he thought it required no philosopher to tell them how the dividends had disappeared. But for the great change which had come upon the whole railway business of the continent, they would now have been in receipt of larger dividends than ever before. He knew Mr. Childers to be an able man, and that he was working hard for the company's interest, but his task would not be an easy one. For himself, when in Chicago the other day, and seeing the unprecedented "cutting" of rates now going on, and the new competition started by the Baltimore & Ohio road, he turned away with a sigh of relief, and had felt thankful that he was not responsible for the fortunes of the Great Western, or of any other railway, at such a time.

Buffalo, Kinross & Philadelphia.

A company by this name has been organized to build a road from the Buffalo & Jamestown at Randolph, N. Y., southward down the Little Conewago Valley and over a short divide into the Allegheny Valley and then to the town of Kinross, Pa.,

where extensive deposits of coal are known to exist and are worked to some extent. The line will be about 20 miles long, and can, it is said, be built with no grade of over 40 feet to the mile. The capital stock will be \$500,000.

New York & Oswego Midland.

There is a partial resumption of travel, a daily mixed train being run over the Northern Division from Oswego to Sidney. On the southern end trains continue to run from Middletown to Ellenville.

Cairo & St. Louis.

At a meeting of the directors held May 5 it was resolved to accept the recently completed section from Murphysboro to Cairo and to issue to the contractors, Payson & Canda, the stock due them on that portion of the work. This will give them a controlling interest in the company. Five years is to be allowed the contractors to complete the remaining five miles from East Carondelet to East St. Louis, for which distance a leased track is now used.

Western Maryland.

This company has petitioned the Baltimore City Council to authorize the use of a portion of the sinking fund for the redemption of the bonds endorsed by the city for the purchase of much needed depot grounds and the erection of the necessary buildings. It is proposed that the city shall hold the title to the property and rent it to the company at 6 per cent. interest on the expenditure, the company to have the right to buy it at any time.

Frederick & Pennsylvania Line.

The Pennsylvania Railroad Company has taken formal possession of this road, under the recently completed lease. It is 23 miles long, from Frederick, Md., to the terminus of the Littlestown Railroad, at the Pennsylvania State line.

Fonda, Johnstown & Gloversville.

A large force is now employed on the extension of this road from Gloversville, N. Y., to Northville, and the ties have been contracted for.

St. Louis, Kansas City & Northern.

Suit has been begun in St. Louis to recover from this company the internal revenue taxes, which became due in 1870 and 1871, on coupons paid by the North Missouri Company on its bonds.

Connecticut Western.

The company is building a new coal depot and yard in Hartford, Conn., to accommodate the increased traffic expected from the opening of the Rhinebeck & Connecticut road.

Arrangements have been made to run a through car between Boston and Albany by the Boston & Providence, Hartford, Providence & Fitchburg, Connecticut Western, Rhinebeck & Connecticut and Hudson River roads, which seems rather a roundabout route, and is some 95 miles longer than the Boston & Albany. It will, however, accommodate the people of a number of large towns along the line.

Kaufman Tap.

This company has secured the money needed to grade its proposed road, from Kaufman, Tex., to a junction with the Texas & Pacific, 11 miles. Negotiations with that company as to furnishing the iron are going on.

McMinnville & Manchester.

The Nashville (Tenn.) Union and American says: "We understand that a compromise has been effected as to all the litigation pending between this road and the Nashville, Chattanooga & St. Louis Railroad Company, and that the suits on either side are to be withdrawn or dismissed at the present term of the Supreme Court."

"The latter company assumes all the liabilities of the stockholders, and pays them four shares for one in stock of the consolidated Nashville, Chattanooga & St. Louis Railroad Company for all their stock."

Cairo & Vincennes.

It is stated that a chattel mortgage for \$86,000, covering all the equipment, has been given to Drexel, Morgan & Co., of New York.

Mississippi Valley & Western.

The United States Circuit Court has decided that, under the lien law of Missouri, the liens for materials furnished and the work done on the road between Quincy and Hannibal hold good over the mortgage on that part of the road. The holders of those liens will therefore share in the proceeds of the recent sale.

Western of Alabama.

A Montgomery (Ala.) dispatch says: "Branch, Sons & Co., of Augusta, Ga., have filed a bill in the Chancery Court here to have the recent sale of the Western Railroad set aside, and the transfer of the Montgomery & West Point Railroad to the Western set aside, as a fraud on the creditors of the old Montgomery & West Point Railroad Company."

Atlantic & Great Western.

Mr. John C. Conybeare, of London, has transmitted to *Herald's* Journal answers made by Mr. J. H. Devereux, the Receiver, to ten questions which Mr. Conybeare addressed to him with regard to the company's affairs, the leased line rental trust bonds, and the lease to Erie. They are as follows:

"1. The leasehold interest in the Cleveland & Mahoning road is embraced in the mortgage to Taylor and Dunphy, trustee, who by virtue of their mortgage have a lien prior to any other."

"2. By the first Leased Lines Trust the trustees of that trust became possessed of nearly all the capital stock of the Cleveland & Mahoning Railroad Company, and consequently the rent payable by the Receiver under the lease before referred to will be paid over by the Cleveland & Mahoning Company to these trustees by way of dividend, and when received will be available as far as it goes for the payment of interest on the obligations, the payment of which the trust was created to secure."

"3. The Receiver will not adopt and has no power to adopt the other leases taken by the Atlantic & Great Western Railroad Company after the execution of the mortgage to Taylor and Dunphy, and hence rent will not be paid by him under these leases."

"4. They are not regarded by the mortgage trustees as profitable leases, hence it would be a breach of duty on their part to assume them as constituting a part of the premises embraced within their mortgage by force of the clauses embracing after acquired property."

"5. As it would seem to be for the interest of the Leased Lines Trust, however, that the Receiver should operate these other lines or roads in connection with the Atlantic & Great Western and Cleveland & Mahoning, it is probable that some arrangement will be made between him and the trustees of the latter trust by which he will be able to do so on fair terms."

"6. It does not seem probable that these trustees will receive from the lines or roads in question sufficient revenue to pay their interest in full."

"7. A final arrangement between the conflicting interests of the leased lines trustees and the mortgage trustees can only be made later between the immediate representatives of the mortgage bondholders, appointed with full power for that purpose, and the leased lines trustees."

Secondly—

"8. If the rent of the leased lines was to be assumed by the Receiver, the revenues of the road in the present exceedingly bad state of business would not be sufficient for its payment."

and not much more than sufficient under the most favorable state of business that could be reasonably expected.

"But as the Receiver has not and cannot assume these leases, the question is not a practical one.

"Thirdly, — The Receiver does not think the entire property worth in its present condition over twenty millions of dollars, and does not think that it would sell for anything like that sum for cash.

"10. As to the Erie lease, it is not now worth while to discuss its provisions.

"The Erie Company now insist that it never took effect, and whether it did or not depends upon certain questions of law. And however this may be, it will be claimed that the lease was put an end to by the receivership, the Receiver taking title not under the company, nor under the lease, but under and directly from the trust deed to Taylor and Dunphy."

Mr. Conybeare calls attention to the fact that the Receiver estimates the property as worth but \$20,000,000, while the English investment in it is about \$60,000,000. He says that if the bondholders wish to save the property, they must combine and take action without further delay.

Louisville, New Albany & St. Louis.

A complaint has been filed in the United States District Court, in suit, to foreclose the mortgage on this road. The amount of bonds outstanding is \$1,252,000, and the completed section of the road is 29 miles long, from Princeton, Ind., west to Albion, Ill.

Portland & Ogdensburg.

The City Council of Portland, Me., voted, May 3, to pay over another installment of \$50,000 of the city's subscription to the road. This makes the whole amount paid \$1,214,182, and leaves \$50,000 yet to be paid.

Portland & Oxford Central.

The bondholders met, May 4, and voted to accept the surrender of the road to them by the stockholders. A committee was appointed to take possession.

St. Joseph & Denver City.

The courts have declined to give the final orders of sale under foreclosure, until it settled what proportion of the equipment was bought with the proceeds of the mortgage on the Eastern Division and what from the proceeds of the Western Division mortgage. When this is decided, there will be nothing further to prevent the sale.

Central Pacific.

The Nevada Supreme Court has decided against the company in the Washoe County tax cases which have been in litigation since 1870, and have been carried through all the courts of the State. The principle involved was the manner in which railroad property should be valued for purposes of taxation. The Washoe County assessor took as a basis the value of the road considered as a whole and assessed it at \$15,000 per mile, while the company claimed that the legal basis was only the value of the real estate occupied and the material of the road, and that the valuation should not exceed \$6,000 per mile. The case was once compromised with the county, but the State officers set the compromise aside and began the suit to recover. The Supreme Court on appeal now decides that the basis assumed by the assessor was right.

Chicago & Illinois River.

The Chicago & Alton Company took formal possession of the completed section of this road May 4, under the recently completed lease. This section of the road is 20 miles long, from Joliet, Ill., west by south to the Mazon River in Grundy County. It was built mainly as a coal road.

Providence & Stonington Steamship Company.

The Stonington Steamship Company, which owns the line from New York to Stonington, Conn., and the New York & Providence Steamship Company, which owns a line from New York to Providence, R. I., have been consolidated under the above name. The new company owns the large side-wheel steamers Rhode Island, Narragansett and Stonington and the propellers Electric, Galatea, Thetis and Doris, the last two being fitted up for freight only. The New York, Providence & Boston Railroad Company owned a large interest in the Stonington Company.

Northampton & Shelburne Falls.

An effort is being made to get the towns of Conway and Shelburne Falls to subscribe \$100,000 to this projected road. A new survey is to be made from Shelburne Falls, Mass., south through Conway to the New Haven & Northampton road near Haydenville, and another line running directly into Northampton will also be surveyed.

Kansas Pacific.

At the annual meeting in Lawrence, Kan., May 7, the stockholders voted unanimously to confirm the contract with the Union Pacific for a division of traffic and consolidation with the Colorado Central.

Securities on the New York Stock Exchange.

The following have been placed upon the list: Morris & Essex consolidated mortgage bonds, amount \$25,000,000, of which \$14,873,000 are held to provide for outstanding issues, the balance to be issued as needed to pay for improvements.

Ohio & Mississippi, first mortgage Springfield Division, amount \$3,000,000, of which \$2,000,000 is issued to pay for the road (late the Springfield & Illinois Southeastern), the rest for improvements and coal branches.

St. Louis, Kansas City & Northern common stock, amount \$12,000,000; preferred stock, \$12,000,000.

Central Vermont.

The stockholders held a special meeting in Bellows Falls, Vt., April 29, and voted to approve the contract for the purchase of the Vermont & Canada road in its amended form.

A floating policy of insurance against loss by fire has been put upon the property of the leased lines and the lake steamers. It is for \$2,160,000 and is in the Liverpool, London & Globe Company.

Southern Pacific.

The track on the San Joaquin Valley line is now laid to Caliente, Cal., 22 1/2 miles southward from Bakersfield. The terminus is now well into the Tehachapi Pass, where the heavy mountain work begins. Concerning this section a correspondent of the San Francisco Bulletin says:

"From Bakersfield the Southern Pacific Railroad runs south-easterly to the foot of the Tehachapi Pass, 18 miles. Thus far the grade is easy and the line almost mathematically straight. At this point we begin to see evidences of the conflict between engineering science and the obstinate elements of nature. Cuts and fillings, and sharp curves and heavy grades appear. A few miles farther up the Pass and we are in a region almost as wild as the Sierra, but infinitely more desolate. The engineering difficulties suddenly become formidable. An elevation of nearly 4,000 feet is to be overcome in a distance of a few miles. To accomplish this will require no less than twelve tunnels aggregating at least 1 1/4 miles. So narrow and tortuous is the gorge in places that the road crosses the Caliente creek no less than eleven times in a mile and a half. A diagram of the road line presents a bewildering maze of curves, angles, sweeps, detours, convolutions and sinuosities. In one place the track makes a sweep of six miles to accomplish half a mile of absolute progress in another place it doubles on itself, piercing through a moun-

tain by a tunnel, coming around and going over the top of it on the outside! Colonel Gray, the chief engineer, and his indefatigable assistants have spent a vast amount of hard work in exploring this Pass, and a practicable line has been found at last, though much of the work will be very heavy and the cost of construction will be very great. The grade on the other side of the Pass will be comparatively easy and the path of the iron-horse to the Colorado river will be unobstructed by a single formidable mountain range."

Western, of Alabama.

On behalf of certain stockholders, a bill has been filed asking for an injunction to restrain the Georgia Railroad Company from completing the joint purchase of the Western Railroad or from paying interest on the bonds of that road indorsed by it. The arguments in the case were to be heard May 11.

Chicago, Danville & Vincennes.

After hearing arguments and giving full consideration to the case, Judge McRoberts, of the Will County, Ill., Circuit Court, has finally decided to acquiesce in the removal of the Osgood foreclosure suit to the United States Circuit Court; and consequently there will be no conflict of jurisdiction in the case. Both foreclosure suits, the Osgood suit and that brought by the trustees, are now before the United States Court.

Proposals for Boston Water Works.

The Cochituate Water Board will receive at its office in the City Hall, Boston until May 20, proposals for building Sections 2, 3, 4 and 5 of the Sudbury River Conduit. An approximate estimate of the work required is as follows:

	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.
Earth excavation and filling, cub. yds.	11,200	8,700	56,500	72,200
Rock excavation, cub. yds.	50	500	2,000	500
Concrete, cub. yds.	520	1,000	1,500	1,400
Brick masonry, cub. yds.	3,500	4,800	2,700	2,400
Rubble stone masonry, cub. yds.	3,940	5,325	2,650	2,650
Dimension stone masonry, cub. yds.	75	150	20	65
Lumber, 4,000 feet B. M.	3,300	350	37	90
Piles, number of	600	.....	.....	700

Specifications may be obtained at the office of the City Engineer, Boston, and plans may be seen at the Engineer's office of the Boston Water Works, at South Framingham, Mass.

Port Royal.

On application of John F. Davidson, a large stockholder, an injunction has been issued restraining the Georgia Railroad Company from paying interest on the \$500,000 Port Royal bonds endorsed by it, and also restraining it from sending any engines or cars belonging to the Georgia road over into South Carolina. The petition in the suit sets forth that the Port Royal Company has failed to comply with the contract under which the Georgia Company endorsed the bonds, which provided that the Port Royal Company should pay the floating debt and provide a line of steamers from Port Royal to North-east ports, and equip the road properly; also that the Port Royal Company owes the Georgia Company a large amount for freight, use and repair of cars, and is unable to pay. Finally, the appointment of a receiver is asked for. The injunction granted is temporary, and a hearing of the case was to be had in Augusta, Ga., May 11.

It is stated that the Georgia Railroad Company instructed its bankers in New York to pay the May coupons on the endorsed bonds, protesting, however, that such payment shall not commit the Georgia Company to the validity of these bonds or any other Port Royal bonds purporting to bear its endorsement.

Savannah & Charleston.

On representation of the Receiver, Mr. C. T. Mitchell, that responsible parties are ready to purchase the road, the Circuit Court has made an order authorizing him to sell it at private sale, subject to the approval of the Court. The road is to be sold for \$1,500,000, provided no greater sum can be obtained, and the terms prescribed are as follows: So much of the purchase money to be paid in cash as will pay the court charges and costs of sale and any arrears of salary that may be due officers and employees at the time of sale. The purchasers to pay \$1,100,000 in bonds bearing 7 per cent. interest and having 20 years to run and secured by a first mortgage on the property. These bonds are to be exchanged for the present first-mortgage bonds, and the old first mortgage shall be thereupon canceled. The balance of the purchase money to be paid in similar bonds secured by a second mortgage, which are to be issued in place of the funded interest bonds, the 8 per cent. bonds and other claims, and those liens canceled. In case the sale is completed, Mr. Thomas Y. Simons is appointed Referee, and he is to hear and decide all questions as to the issue and distribution of the new bonds, subject to the approval of the Court.

It is understood that these terms are acceptable to the parties who wish to buy the road and that they are large holders of its present obligations. The road is 104 miles long, making the price fixed about \$14,500 per mile, but a considerable expenditure is needed for terminal facilities and connections both at Charleston and Savannah.

Elkhorn & Humboldt.

Contractors, it is reported, have offered to build this narrow-gauge road from Woodland, Cal., to Langville, 16 miles, for \$110,000, which is only \$6,875 per mile.

Stockton & Ione.

A large lot of rails, which were purchased for this road, and which have been lying in Stockton, Cal., for some time, have been sold to the Palisade & Eureka Company and shipped to Nevada to be used on that road.

Chicago & Pacific.

A mortgage of the part of this road in De Kalb County, Ill., has lately been recorded. It runs to the New York Loan and Trust Company. We believe that this company has not yet sold any bonds.

Plymouth, Kankakee & Pacific.

The Putnam (Ill.) Record says: "On Saturday last [May 1] the road-bed of the Plymouth, Kankakee & Pacific Railroad, from Bureau Junction to the Indiana State line, was sold, and also the depot grounds at this place [Hennepin], and a lot of 416 ties. The sale was by special commissioner, to satisfy a claim held by Mr. T. J. Nicholl. Mr. Nicholl bid off the road-bed at \$2,804.73, and the depot grounds for \$375, making in all \$3,179.73. The ties were purchased by H. C. Thomas for \$99.80, cash. The amount of Mr. Nicholl's claim was \$3,168.40. The road-bed and depot grounds are subject to redemption."

Erie.

The famous Portage Bridge over the Genesee River, 30 miles northwest of Hornellsville on the Buffalo Division, was destroyed by fire very early on the morning of May 6. The fire is stated variously to have been caused by an incendiary and by sparks from an engine, the former being apparently the most probable, as the timber in the bridge could not have been very dry after the recent heavy rains. The watchman who discovered the fire went for aid, but it had gained so much headway when he returned that all efforts to save it were futile. The bridge is believed to have been the largest trestle bridge in the United States. It spanned a gorge through which the Genesee River flows, was 800 feet long, and the highest of the trestle piers was 234 feet from the reach of freshets. There were 13 of these piers, and the masonry was carried up high enough to be beyond the reach of freshets. Its original cost was \$180,000 and over 1,800,000 feet of lumber were used in it. It was designed by Gen. Silas Seymour, then Chief En-

gineer of the Buffalo & New York City road and now Consulting Engineer of the North Shore Railway of Canada.

It was begun in April, 1851, and completed August 24, 1852, by Laurman, Rockafellow & Moore, contractors. The bridge was so designed that any piece of timber could be taken out and replaced without interference with the rest. It is said that not a piece of the original timber remained in the structure, all having been renewed.

It is stated that the company will replace it with an iron bridge as soon as possible. Meantime through trains are run over the Rochester Division from Corning to Avon and thence over the Attica Branch, coming upon the Buffalo Division at Attica.

A contract for a new iron bridge has been let to the Watson Manufacturing Company of Paterson, the work to be finished in 45 days.

Missouri River, Fort Scott & Gulf.

In our statement of the earnings for 1874, published May 6, the proportion of working expenses to gross earnings was given as 59.65 per cent. It is proper to say that a large proportion of this was an expenditure for taxes, which seem enormously high and are, of course, beyond the control of the company, though we are in the habit of including them with working expenses. Another portion should not have appeared with working expenses at all, being for new construction, and amounting to about 1 1/2 per cent. of the earnings. Excluding this expenditure for construction and the taxes, the figures for this year are:

	1874.	1873.	Inc. or Dec.	P. c.
Earnings.....	\$893,400	\$707,982	Dec., \$185,418	2.1
Working expenses.....	348,106	416,203	Dec., 68,097	18.6
Net earnings.....	545,294	291,779	Inc., 253,515	18.4
Earnings per mile.....	4,534	4,425	Dec., 109	2.1
Per cent. of expenses.....	50.30	58.78	Dec., 8.48	...

The taxes for the current year have been assessed at \$55,640, having been last year \$44,040. The company contests the validity of the assessment, however, and hopes to pay no more than last year. The taxes as assessed amount to about 8 per cent. of the gross receipts of last year—a rate which would make the Pennsylvania Main Line pay more than \$5,000 per mile.

Peruvian Railroads.

It seems probable that most of the railroads constructed in Peru recently, to secure the capital invested in which the government hypothecated its valuable guano property, will be unproductive. The Minister of the Argentine Republic says of the famous Oroya Railroad, which has cost more than \$20,000,000, that it is a wonder of engineering, but that many years must elapse before it produces anything, as the country is a desert. And in his message to the Peruvian Parliament last year, President Pardo says: "My predecessor, Balta, formed the idea of converting our guano into railroads. In two years he contracted for nine railroads, to cost \$125,000,000, which money being raised by foreign loans, the Dreyfus guano contract for \$8,500,000 yearly would pay the interest. Such enormous loans soon crippled us, as the railroads were unproductive. At the same time the sudden influx of a hundred millions of dollars in two years upset our equilibrium. Everything ran up to fabulous prices and assumed fictitious value. Living became extravagantly dear, then came failures and suspensions, and all the troubles that have reduced Peru to her present wretched condition."

Chicago, Milwaukee & St. Paul.

At the next annual meeting, which will take place June 12, the stockholders are to vote upon the question of accepting a law which repeals the present classification of directors and provides that the terms of all the present directors shall end June 12. In case the law is accepted, the stockholders will have to elect an entirely new board. The Mitchell party is in favor of accepting this law.

Evansville, Washington & Chicago.

This company has filed its articles of association in Indiana. The capital stock is to be \$750,000, and the road is to run from Evansville, Ind., northward through Petersburg and Washington, and thence north by west to the Wabash River in Sullivan County. The general course is parallel to the Evansville & Crawfordsville, and for the most part 10 or 12 miles eastward of that road.

Gareysburg & Salmon Creek.

Meetings are being held and efforts made to secure the building of this road from the Seaboard & Roanoke at Gareysburg, N. C., southeast through Northampton and Bertie counties, a fertile farming region.

Suffolk.

Messrs. Jackson & Co., lumber manufacturers, of Suffolk, Va., are now building a narrow-gauge railroad from that place southward to tap the lumber region around the Dismal Swamp. It is probable that it will eventually be extended to Edenton, N. C.

Valley, of Virginia.

The adjourned general meeting of the stockholders was held in Staunton, Va., April 29. The committee appointed at the January meeting reported that the work of construction had been thoroughly and efficiently done, but that a less costly and substantial road would have been better, in view of subsequent disappointments as to traffic, the net results of which have been far from satisfactory. Proposals to lease the finished section of the road were solicited, but only one was made—that of Robert G. Bickle—for 10 years at \$30,000 per annum, subject to certain conditions. The committee is decidedly of the opinion that it would be injudicious to accept this offer, in view of the financial results of operating the road and the present distrust of railroad securities. The committee believe it would be impossible at the present time to negotiate the contemplated mortgage, or any part thereof, on terms favorable to the company, or which would insure a sufficient sum to complete the line under the estimates, and therefore reluctantly recommended that no efforts be made at present to resume the work, but that the expenditures be reduced. The gross earnings for the past twelve months have been \$38,850; the net earnings \$1,149.60. Accompanying the report were estimates by Chief Engineer Randolph, and the proposition of Mr. Bickle. The committee has examined and found correct the accounts with the Baltimore & Ohio Railroad Company.

Mr. Anderson, of Rockbridge, dissented from the report as to the fairness of the charges made by the Baltimore & Ohio Railroad Company for construction, and submitted a report, signed by himself, in which he claimed that too high a price was charged for rails.

President Robert Garrett submitted a financial report, showing the liabilities of the company to be \$323,000, and the assets some \$90,000, inclusive of real estate.

A resolution was adopted instructing the board to adjust the accounts with the Baltimore & Ohio Company, subject to such corrections as might be found proper.

The meeting was continued the next day, the Staunton City Council in the meantime having refused to order the issue of the \$50,000 city bonds to the company. It was stated that the Rockbridge County board had made a proposition which the representatives of the Baltimore stock did not feel authorized to vote on without further consultation.

President Robert Garrett presented his resignation, but was requested to withdraw it and finally consented to do so, until his successor could be agreed upon. The committee to confer with the contractors reported that there is due the contractors \$303,000, and that it had been agreed that \$190,000 should be

paid in money and \$113,000 in bonds. The report was adopted. After further discussion on the affairs of the company, the meeting adjourned subject to the call of the chair.

THE SCRAP HEAP.

Large Lake Propeller.

The new propeller now on the stocks in Cleveland for the Western Transportation Company will, when completed, be the largest freight boat on the lakes. Her extreme length is 275 feet, beam 42 feet, and depth of hold 16 feet. Her carrying capacity is estimated at 2,500 tons. Her designers confidently expect that she will carry 80,000 bushels of wheat, equal to 2,400 tons, in the hold alone, on a draught of fourteen feet of water. She will not be fitted out as a steam barge, but is to resemble other propellers owned by the company in general appearance, carrying a single spar, one smoke-stack, and accommodations for the crew on the upper deck. Two powerful compound engines will drive a single shaft and wheel, and the boat is expected to be driven at the rate of fourteen miles an hour when necessary. Such a vessel's load of wheat in the hold will be equal to 240 full car loads.

Fast Time.

On Saturday, April 17, the Pacific express eastward on the Chicago, Burlington & Quincy Railroad made the following time, said to be the fastest ever run on that road: It reached Galesburg about three hours late, and in running to Aurora, 125 miles, made up the lost time. This distance it made in 2 hours and 46 minutes, including stops, which are reported to have absorbed only eleven minutes. The effective speed was thus a little more than 45 miles an hour, and excluding stops it was 51 miles an hour. The engine making this time was No. 139, built in the Aurora shops by the late Superintendent of Machinery, Mr. C. F. Jauriet, and recently rebuilt there. The same distance was once run by another engine in 2 hours and 49 minutes.

Railroad Manufactures.

The Lehigh Car Wheel and Axle Works at Catawauqua, Pa., have recently made several shipments of car-wheels and axles to Brazil.

The Western Iron Company, at Sharon, Pa., is running its rolling mill double turn, and all the puddlers are at work.

Riehle Brothers, of Philadelphia, are making all the track scales for the Easton & Amboy road, the Lehigh Valley's extension across New Jersey.

The Revolving Scraper Company, at Columbus, O., is running its works full time, and turning out Doty's patent revolving scrapers and other contractors' tools in large quantity.

The St. Louis Bolt and Iron Company's works are running double turn, and are manufacturing street and mine rails, fish-bars and bolts, and have orders for some time ahead.

The Pacific Rolling Mills in San Francisco have now in operation one 12-inch guide train, one three-high 18-inch train for rails, one pair coffee-mill squeezers and an 18-inch puddle mill. There are five heating and six puddling furnaces. The mills have a capacity of 60 tons of rails and 45 tons of bar iron per day. A new 12-inch train and a wire mill are being added. In the forge shop there are three large steam hammers, and some very heavy quartz mill work is now being turned out. The mills also manufacture bolts, nuts and spikes.

The Kimball Manufacturing Company of San Francisco recently completed another lot of passenger cars for the North Pacific Coast road.

A shop for the manufacture of steel frogs is to be built in Harrisburg, Pa.

Samuel A. Randall and Benjamin M. Jones, of Boston, have formed a co-partnership under the firm name of Randall & Jones, and have been appointed sole representatives in this country of the English firms Taylor Brothers & Co., of Leeds, and Samuel Osborn & Co., of Sheffield, to sell in the United States the iron, crucible cast steel, locomotive tire, boiler plate and various tool and other steels manufactured by these firms.

"You Got Him, Boss!"

The Richmond (Va.) *Enquirer* says: "Rather a serio-comic incident occurred at a station on the Richmond & Danville Railroad, a few days ago. An engineer having occasion to back his train on to a siding to take on an extra car, a negro who was to do the coupling got caught in between the bumpers of the car and the train, and though not seriously hurt, had the breath pretty well knocked out of him, and was unable to move. Another negro who saw his predicament crept up to the engine, and drawing the engineer aside said to him in a confidential whisper, 'Boss, you got him.'

"What?"

"You got him, Boss, sure enuf dis time. He can't move nor holler needer."

Still puzzled, the engineer again demanded an explanation, when the negro sank his voice lower, and giving a knowing leer, said:

"Boss, I specs you better run; nobody seed you, and then disappeared."

About this time the fireman who had gone back came forward and explained matters, but it is evident that the negro thought the squeeze was done on purpose."

How He Flagged a Train.

A most unfortunate man is Tom Welch, a person not a millionaire, lately employed in the service of the Chicago & Alton Railroad. Tom did not occupy a prominent position in the management of the road; he was one of the useful class working under section bosses, who travel on hand-cars and attend to keeping the track in order, and that he has been discharged is really no fault of his. Tom's labor was of the class in which good clothes would be out of place, and Tom wore patched garments, his pantaloons especially being of the most ancient and dilapidated type. In fact, so long ago were those pantaloons first put on that most of the original material disappeared months since, and in the seat the patches had been so often renewed that on the occasion of the last patching Tom's good wife found difficulty in finding material suited for the purpose.

In her strait the worthy woman was driven to the use of bright red flannel, and when those red flannel patches were placed upon the calf of his back, Tom, from a rear view, looked as if blushing continuously at his own appearance. Now, it so happened that a few days ago the "boss" sent the faithful Tom out along the track to screw up more firmly the connections of the rails, and so industriously at work Tom went, stooping over to the work and presenting a blazing view to any one in the proper direction. The up train from the South was late on the day in question; the engineer was, as he expressed it, "letting 'er rip." Suddenly the watchful eye of the man running the locomotive perceived the danger signal half a mile in front, and instantly the engine was reversed, the air-brakes applied and the train brought to a stand-still. For a long time the train was held, but the signal failed to approach nearer, though it bobbed back and forth across the track in a most unaccountable manner. It was a wonderfully active flag; tired of waiting, the conductor finally told the engineer to go on slowly and so the train forged gingerly ahead. So the train went on until within about a quarter of a mile of the signal, the engineer keeping a keen look-out. Then all at once the engineer swore an oath so big the fireman almost fainted and at the same instant pulled the throttle wide open. The train dashed fiercely ahead at sixty miles an hour, but the engineer swore at a bigger rate than that. Then the conductor came and helped him swear, and the air turned blue. The train got to its destination behind time, and the next day Tom Welch was discharged just because the company had a prejudice against a man who wore patches big enough and red enough to flag a train.—*St. Louis Republic*.

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A Railroad Race.

The Scranton (Pa.) *Republican* of April 28 says: "George Shoemaker, engineer of a coal train of some fifteen cars on the Delaware, Lackawanna & Western Railroad, had an exciting experience a few evenings ago in the vicinity of Forks Station, on the Pocono Mountains. At that point there is a heavy grade toward the Delaware Water Gap, and when within two miles of Forks Station, while the train was going at the rate of ten miles an hour, the coupling broke, cutting some ten cars loose and letting the engine shoot rapidly ahead with five cars, which remained attached. Two brakemen on the severed cars, seeing they were left behind to the care of a swift momentum, became frightened and leaped from their positions. As soon as they jumped off the brakes were relaxed, giving the cars full scope and increasing their velocity. Mr. Shoemaker, who was some distance ahead, seeing them approach, feared the consequences of a collision, and increased his speed to avert the catastrophe of clashing with the runaway cars. Accordingly he maintained a swift course, passing Forks Station with a shriek and startling the officials at that place, who did not know what was the matter. A minute later the telegraph operator dispatched to Scranton that train No. 26 had passed the station at the rate of sixty miles an hour. He had scarcely sent the message before the runaway cars came crashing through the cut, and thundered through the station like a lightning flash, impelled by the power of gravity. The people in the vicinity of Forks Station were alarmed by this time. They thought all the coal cars in Scranton were out for a holiday and dashing madly in the direction of the Water Gap. The operator sent a second and more exciting message than the first to the Scranton office, while the chase was being continued. After a five miles' run, Conductor Shoemaker so slackened speed gradually as to render the shock of contact with the pursuing train harmless, and in this way brought up with no injury save a good shaking and a fair share of excitement."

Payment by the Trip in England.

The Midland Railway is endeavoring to introduce the trip system for paying train men, which seems to be generally opposed by the men, who are now paid by the hour. It has been tried in England, but was generally abandoned some years ago, it seems.

Crossing Signals.

A correspondent of the *London Railway Service Gazette* says: "In my opinion, the only thing to make level crossings a place of safety is to adopt the use of 'throw-off points' and 'dead ends,' made up of ballast, and the use of detonators to work with the signal. By detonators being worked with the signals, trains are made secure from coming into collision with each other when a train is crossing in the opposite direction. First, you have the signal dead against him; second, the detonators would explode if he attempted to disregard it, which would alone tell him that he was wrong; and, third, so long as the signal was at danger, the throw-off points would stand so as to turn him into the dead end, and, besides this, the home signal could be made to lock with the distant, so that then they would both show danger and caution together. I think the following statement will convince you that the above suggestions are in favor of making these places safe. When signals are disregarded in nine cases out of ten it ends in hard swearing between the driver and signalman, and whether the signal was at danger or not; but where the throw-off points are in use (as in the case I am about to relate) it shows for certain who is to blame. A driver was proceeding with his train to a certain crossing, but the gauge glass having broken, his attention was given to that, and he was obliged to have his back to the signals. I have no doubt he was under the impression that his fireman would keep a good look out. But to the great surprise of both and the alarm of the passengers, the progress of the engine was suddenly stayed by it becoming embedded up to its axles in ballast. As another train was signalled to cross over, he should have stopped at the home signal, which was dead against him, until the train had passed clear, and the signal was lowered for him to proceed. Had there been no safer protection than the signal without the throw-off points, it might possibly have been one of the worst accidents of its kind, as there would have been no alternative but to have struck the crossing train as nearly in the middle as possible, which would have cost the company thousands of pounds, besides a sacrifice of human beings."

English and American Railroads.

At a banquet given to Mr. Joseph Price at Hamilton, Canada, on his leaving the road, which he had served eleven years, most of the time as Treasurer but latterly as General Manager, that gentleman made a speech, from a report of which in the *Toronto Mail* we copy the following: "Mr. Price himself, when it came to his turn to speak, said some things which English proprietors of Canadian railways would do well to take note of. English railway men coming over here, he said, thought they could teach us how railways ought to be managed, but his experience was that they generally learned here more than they taught. The American railway system was as a whole superior to the English system; there was less unprofitable and needless work done here than in England. Mr. Allport, one of the ablest railway managers in England, had examined the American system, and the consequence was that he was rapidly introducing many of its distinctive features. He was adopting the American passenger system to a large extent, and would soon have thirty-eight Pullman cars running, more than there were in all America eight years ago."

Signalling at the Bergen Tunnel.

The *Journal of the Telegraph* gives the following account of the method of running trains through the Bergen Tunnel:

"The electric signals by which this plan of running trains is carried out are connected by insulated wire or covered wire running over the hill, thus making the connection between the two signal houses, which are at each end of the tunnel. In each of these houses is an electrical signal machine, which is so arranged that when the key is closed at one end of the tunnel the bell strikes four times at the other end, and by this the signalman knows that a train has just passed out at the other end all right, and that he can let in another. It is a rule that two trains shall not be let into the tunnel at one time on the same track, and that on the rear of each train must be a red light, and the signalman, whose duty it is to send back the signal 'all right,' must see that the train has such lights on the rear of the car when it passed by the signal-house. In a busy time the two roads that use this tunnel, the Erie and Delaware, Lackawanna & Western, often run as many as 300 trains through in a day, and it is often the case that two trains went close up to the mouth of the tunnel, or the place where they are all obliged to stop before going in, at nearly the same time, and the train that stops first has the right of way in the tunnel, the other not being allowed to start in until the one preceding it has been signalled back as having passed through all right."

A New Covering for Steam Pipes.

A new method of covering steam pipes is being applied in different mines of the Saarbrücken district, which has proved very efficient. A coat of thin loam wash is first given to the pipes, which serves to increase the adhesion of the mass with which they are to be covered. The composition consists of

equal parts of loam or clay, free from sand and brick dust, with an addition of cow hair. This is well mixed up and put round the pipes in a hot state. For better securing this coating, wood splints, 0.26 metre long, 13 m. broad, and 22 m. thick, are laid along the whole length of the pipes and fastened by thin iron wire. After applying the loam wash again to the dried mass till all the cracks have disappeared, the pipes receive another coating of the mass, until they feel quite cool, which will be attained after the mass has been laid on to the thickness of from 124 m. to 140 m. A coat of linseed oil and cement is finally given. This method answers at present all requirements, the covering being perfectly air-tight and free from cracks. The mass is not hygroscopic, a property making it all the more suitable for pipes in the open air. The cost of the covering per foot of 8-inch pipe is 6d., while the expense of the old proceeding amounted to nearly 8d. The inventor, Herr Weiss, has taken out a patent for his method.

Extension of the Metrical System.

This system of weights and measures, which has heretofore been introduced into France, the Netherlands, Belgium, Luxembourg, Italy, Spain, Portugal, Greece, Roumania, the German Empire, Mexico and most of the South American States, is to be made obligatory in Austria on and after January 1, 1876. The Scandinavian countries, Russia and Turkey will then be the only considerable countries on the Continent of Europe which adhere to their old systems. Scarcely any two have had the same standard, as the following comparisons of the miles of different countries with our English mile will show:

Geographical mile.	English mile.	Saxon mile.	English mile.
Baden mile.	1.15074	Württemberg mile.	5.63118
Bavarian mile.	5.52356	Austrian mile.	4.71438
Brunswick mile.	4.60143	Swiss mile.	2.85579
Hanover mile.	4.51030	Russian verst.	0.66296
Prussian mile.	4.68606	Swedish mile.	6.64179

It is easy to believe that any escape from this confusion is an improvement, though in the case of some of the States which have made the change recently it must have been very costly.

A Way of Putting It.

This is the way the Cincinnati *Enquirer* announces the appointment of a Receiver for the Northern Pacific: "The Northern Pacific Railroad, owing to the failure of the banana crop, has passed into the hands of a receiver."

RAILROAD LAW.

Breaking a Railroad Car with Intent to Steal.

The Ohio Courts have decided that where a person is indicted for breaking and entering a car, and for larceny of goods from it, and is convicted of the larceny only, judgment will not be reversed because of the admission, against defendant's objection, of evidence for the sole purpose of proving the breaking and entering. The fact that a person is in the employ of a railroad company on a freight train does not imply such control or possession of goods being transported on the train that he may not be convicted of the larceny thereof.

Liability of Common Carriers for Delay.

In the case of Blaisdell against the Illinois Central, which was an action to recover damages for unreasonable delay of grain in transit to Cairo, on appeal from the Circuit, the Supreme Court of Illinois holds:

1. That if the defendant failed to transport the grain to its destination within a reasonable time, and the price declined at Cairo, then plaintiffs could recover the difference in price between the time when it should have arrived and the time when it did arrive; or if in consequence of the delay there was no market at Cairo, the plaintiffs would have a right to ship it to a point where there was a market, sell it to the best advantage and hold the carrier for the loss.

2. The price for which the plaintiffs sold grain at that time in Cairo is held competent as showing the market price at that time.

3. Correspondence with another firm for the purpose of establishing market price of corn is not competent evidence.

4. The recovery of interest depends entirely upon the statute.

5. The measure of damages is the difference between the market price when the grain should have arrived and when it did arrive. If there was no market in Cairo, plaintiffs were bound to find a market and dispose of it as advantageously as possible.

6. The burden of proof is on the plaintiffs to show the disposition actually made of the grain, the price received and the expenses, etc.

Right of Common Carrier to Refuse Ordinary Freight.

The Canadian Court of Appeals has recently rendered a decision against the Grand Trunk Railway Company, in a case involving the right of a common carrier to refuse to transport ordinary freight. The cause arose from the refusal of the road to carry cedar lumber over its line from the cedar regions to market, because it desired to discourage the cutting of this timber, of which it uses a large amount, and thus to prevent a scarcity, by which the road in time would be compelled to pay much more for its supplies in case it could obtain them at all. The lower courts sustained the road in this refusal, upon an action brought to compel it to receive and transport the said lumber. The Court of Appeals, however, reversed their decision, upon the ground that under the Railway Act of the Dominion roads are bound to carry all passengers and goods duly tendered thereon, unless they have good reason to refuse on account of their being dangerous, or some other sufficient cause.

Duty of a Railroad Company as to Road Crossings.

The Supreme Court of Tennessee on appeal has given a decision in the suit of the State against the Nashville & Decatur Company. The company was indicted for crossing a dirt road and obstructing it, and its charter required that in such cases it should make the crossing "as convenient as may be." The Court decides that this does not mean that the new road must be as convenient and easy of passage and as safe as the old road, but that the new road should be so constructed as to answer the purposes of the traveling public, and be made as easy and convenient as the nature of the ground will permit, having due regard to the rights of the public, and at the same time not requiring unreasonable outlays of money by the company.

Dunham & Widney Brake Shoes—The Patent Valid.

In the United States Circuit Court at Chicago April 21, Judge Drummond decided that patent No. 4,466, issued July 11, 1871, to Wm. H. Dunham, James Widney and Samuel P. Ross for an "Improvement in Car-Brake Shoes" is valid, and that the representatives of the patentees are entitled to recover from the Grand Rapids & Indiana Railroad Company all gains and profits from the use of the patent and costs of suit. An injunction against further use of the patent was issued and a master appointed to report the amount of damages.

Michigan Railroad Law.

A bill has been passed by the Michigan Legislature and approved by the Governor, requiring railroad companies, in case of accidents resulting in the death of any person on their road, to promptly notify the nearest resident coroner. They are also required to notify the State Railroad Commissioner of all accidents. It is made his duty to examine into all the causes of fatal accidents, and he is empowered, in his discretion, to make similar examinations in cases where no deaths occur.